

THE
MINING AND METALLURGICAL
JOURNAL

Vol. XXIII. No. 4

New York, N. Y.

November 15, 1900

Los Angeles, Cal.

Price 15 Cents

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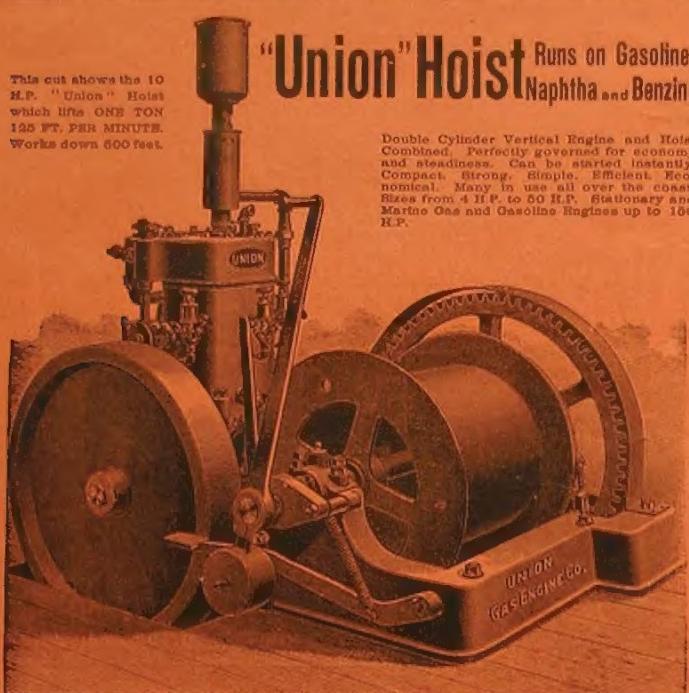
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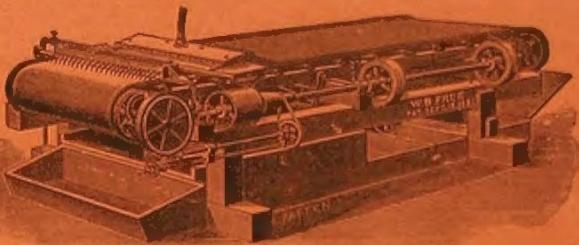
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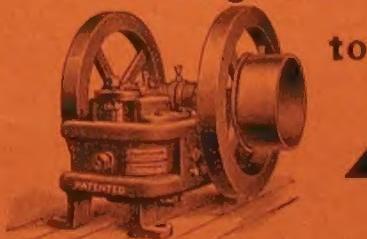
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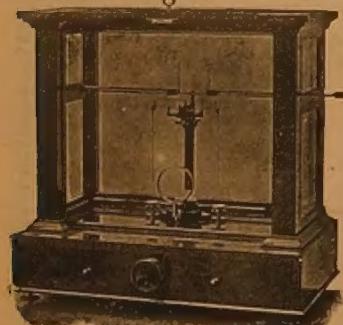
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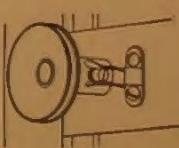
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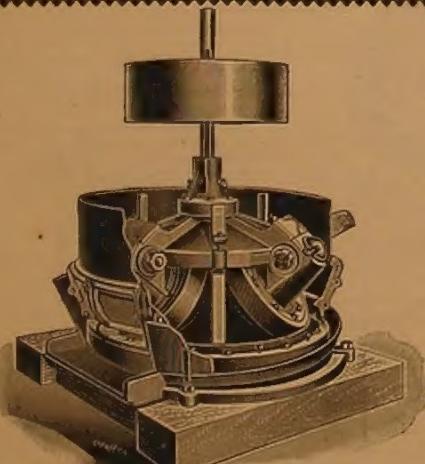
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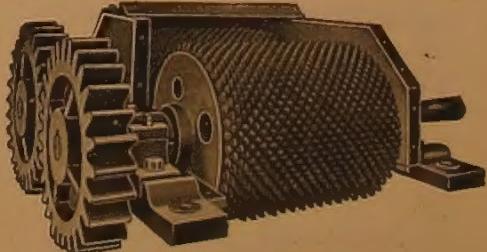
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SUBSCRIPTION PRICE:

For United States, Mexico and Canada... \$2.50 per annum
All other countries in the Postal Union... \$3.50 per annum

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Iron and Steel.

BRITISH INQUIRY FOR STEEL—FRENCH
COAL AND IRON PRODUCTION.

Coal and Coke.

BRITISH EXPORTS AND PRICES—ANTHRA-
CITE PRICES IN THIRTY-FIVE YEARS—
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Mining Stock Quotations.

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The Metal Markets.

Mining Interests in the South.

Dr. Joseph H. Pratt, a well-known mining engineer of Chapel Hill, N. C., writes to the editor of the Manufacturers' Record as follows concerning the future of the South's mining industry:

"Mining and engineering industries in general have never been in as prosperous a condition as they are at the present time, and this is especially noticeable in our Southern states. For the past two or three years investments in mining and mineral properties have been carried on in a more conservative manner, but there is still need of a determined effort on the part of those interested in the real and substantial growth of the South along this line to keep down fraudulent propositions and those that are being too highly valued to the gain of the promoter and the loss of the investor. Never has the South had the opportunity that she now has of obtaining capital for the development of her mineral resources, and with a conscientious endeavor on the part of the owner or agent and the consulting engineer they should be found profitable investments to the capitalist."

Our Iron and Steel Supremacy.

Fresh confirmation of our supremacy in the iron industry of the world is afforded by the interesting monograph on the subject recently issued by the Treasury Department. The figures will be everywhere accepted as authentic and will place beyond dispute the supremacy of the United States among iron-producing nations. For five years we have continuously outranked Great Britain as a producer of pig iron (having passed her temporarily before that), and she is now hopelessly in the rear. Our tonnage last year of 13.6 millions, as compared with 9.3 for Great Britain and with 8.1 for Germany, the third contestant for world honors.

To summarize the situation in a single sentence it may be said that the United States in 1899 produced thirty per cent of the world's iron ore, forty per cent of the world's steel and thirty-two per cent of the world's coal. Great Britain pressed us closely in the matter of coal with a thirty per cent production to her credit, but in steel her percentage is only 18½ and in iron ore only seventeen.

Twenty years ago the United States imported five times as much in value as it exported of iron and steel products, whereas the figures are now more than reversed, as we exported last year six times as much as we imported. These exports in the last fiscal year aggregated 121.9 million dollars, only three commodities surpassing them—breadstuffs, cotton, and provisions.

Scrapers vs Mineral Claimants.

As if to prove what was said in our issue of August 1, when commenting upon Judge Ross's decision in the case of the Olive Land & Development Co. against Wm. H. Olmstead and others, the statement has now come forth that Judge Ross has reversed his former decision, by his recent decision in the case of the Cosmos Exploration Co. against the Gray Eagle Oil Co. and in that of the Pacific Land & Improvement Co. against the Elwood Oil Co., both tried as one. That statement is also wrong, as the decision given in the last-named case does not reverse the former one in any way, the cases being without a parallel in any sense of the word.

In the case of the Olive Land & Development Co. against Wm. H. Olmstead and others the scrapers had a valid location first, and so, of course, could not be dispossessed, while in the cases just concluded the mineral claimants were in possession by virtue of a mining location and

were actually drilling for oil at the time the scrapers attempted to make the selection. These two decisions pretty thoroughly establish the fact that cases will in the future have to be tried separately. There can be no sweeping decision against either class of locators.

In the case of the Cosmos Exploration Co. it seems the predecessors of the scrapers relinquished the title to a piece of patented land owned by one Clarke in a forest reservation in November, 1899, and December 8, 1899. Clarke made a selection of land at the time occupied by the Gray Eagle Oil Co. by right of a mining location made in June, 1899. In the case of the Pacific Land & Improvement Co. the selection was made by J. H. Johnston, the predecessor in the case of the Olive Land & Development Co., on December 28, 1899, and the land then selected had been occupied since June, 1899, by the Elwood Oil Co. and others, by virtue of a placer mining location.

The complainants used every precaution to endeavor to make their claim stronger, such as making affidavits in positive terms that the land at the time of selection contained no evidences of oil or other mineral. Some of them stated that the land was unoccupied, was without buildings, derricks or other structure, and others stated that they did not see any such improvements or evidences of possession. They stated that they had been over the ground and knew, or professed to know the character of the land. Many of them further stated in positive terms that the lands were covered with a good growth of native grasses, and some of them stated that such growth was luxuriant and that they were good grazing lands.

Judge Ross says: "If instead of these palpably false and fraudulent statements, the affidavits accompanying and in support of the selections, had stated the truth—had stated that the applicants at least believed the land sought contained oil and that they wanted them for that purpose and for that purpose only, and desired to select them under the law authorizing agricultural lands to be taken in exchange for lands situated within a forest reservation that had been surrendered to the government, no one can doubt that the officers of the local land office would have refused to file or receive the selection of land under the Forest Reserve Lien Land Act."

These affidavits more clearly defined the intent to get possession fraudulently of the property, and when it is considered that the lands were surveyed and within a few miles of the prosperous town of Bakersfield, and were never at any time, so far as appears, considered of sufficient value for agricultural or grazing purposes to be taken up by any one at the nominal price for such lands fixed by the government, until after they had been located under the mining laws for oil, it ought not to be a difficult matter for any fair mind to determine on which side is the preponderance of proof.

The injuries alleged in the bills themselves as grounds for the preliminary relief asked are not injuries to the land as agricultural ground, but consist in their despoiling by the extraction of the mineral oil they contain.

Judge Ross says:—"The fundamental question in every suit in equity is on which side is justice? Law unfortunately is sometimes not justice, but equity always is. One who is in actual possession of a mining claim, working it for the mineral it contains, and claiming it under the laws of the United States, whether the location under which he so claims it is valid or invalid, cannot be forcibly, surreptitiously, clandestinely, or otherwise fraudulently intruded upon, or ousted while he is asleep in his cabin or temporarily absent from the claim, for he is there by the permission and invitation of the owner of the land—the United States."

The Red Ash Colliery Explosion.

A Description of the Mine—The Havoc Wrought by the Explosion—A Careful Analysis of the Possible Causes.

By W. N. Page, Ansted, W. Va.

The Red Ash colliery, Fayette county, West Virginia, was the scene on March 6, 1900, of an explosion by which some fifty men were killed or wounded, and much property was injured or destroyed. On March 19, the earliest date at which entrance was practicable, I examined the mine with the view of determining the extent, cause and point of origin of the explosion, and with the permission of F. Howald, the manager, and the owners of the property, for whom the examination was made, I present in this paper some results of that examination, comprising the essential portions of my report to them.

LOCATION AND PLAN OF THE MINE.

The Red Ash colliery, situated on the south side of New river, next below the Rush Run mine, with which the underground workings are connected, is a drift-mine, the entrance to which is on a slope, about 500 feet above the river.

The main entry has been driven north about 4,000 feet from the surface, with parallel entries on either side from the fourth set of cross entries, and about seventy feet of chain-pillar between the parallels. Except where interrupted by a squeeze cross entries have been driven east and west at intervals of 400 feet, with parallel air ways, constituting a complete double-entry system, remarkably regular and uniform, aside from the squeeze referred to. About seventy-five feet west of the entrance an exhaust fan is located in the mouth of the parallel air way on the left or west side of the main entry, which parallel is broken by the squeeze, but connected at the fourth set of cross entries, through workings to the westward, giving about the same effect as if the air way had been continuous. I did not measure the efficiency of this fan; but the mine workings have been planned for an excellent system of ventilation, which should be ample for every requirement, with any standard centrifugal machine proportioned to the work. The fan is driven by compressed air, which is frequently used for such purposes, and I understand that several others of the same model and make are employed in the district, giving satisfactory results. Under the plan of ventilation, the main entry is the intake, with an average cross section of about six by twelve feet, or seventy-two square feet of area, which is more than enough for the safe working requirements of the mine. The current is directed to the head of the intake, where it is split, and conducted across the face of the workings to the east and west, through a system of trap doors, brattices and stoppings; that on the east returning through an overcast at the fourth cross entry. With the double entries and break-throughs from room to room, as shown on the plan, there is no reason why the circulation should not have been as nearly perfect as any artificial system of ventilation can be made, as the entries and air ways are unusually straight, with ample cross sectional areas to reduce friction and resistance to a minimum. I feel safe in saying, therefore, that if there was lack of circulation at the time of the explosion, it cannot be attributed to any defect in the system or the general plan of the mine workings.

EXTENT AND EFFECT OF THE EXPLOSION.

The main entry showed no evidence of unusual heat or flame, beyond what might be expected along the intake, from an ignition of gases in some other part of the mine; the heated air and flame being necessarily thrown toward this entry, as offering the line of least resistance to daylight.

Beyond the ninth cross entries, the force had been exerted toward the face or inward, and from these entries, outward, everything had been swept toward the entrance like shot from the barrel of a gun—to which this entrance may be likened, the expanded air and gases in the extensive workings representing those of the enlarged powder chamber of the gun. From the fifth cross entry there were three escapes for the pressure they produced, the main entry being the shortest, and the only straight one. A second was the parallel air way on the west, which turned squarely to the west at the fourth entry, and had to pass through the "squeeze" by devious route, before reaching daylight at the fan, which also operated to obstruct this outlet. The third way was down the west fifth entry to the Rush Run workings. Between these and the Red Ash there was a brattice, or stopping, which was blown out; and in addition to which there must necessarily have been, in that direction, other resistance due to old workings.

The walls and roof of the main entry were covered with white dust from the floor, showing that the clay in the tracks and roadbeds had been swept out through this channel with considerable force. At the fourth cross entry the overcast timbers were blown straight down, showing that the contracted area of the stone drift through the squeeze had dammed back the force and equilibrated the pressure from the east workings, the return from which was through the overcast at this point.

The fourth cross entry east shows the effect of heat, as if it had been filled with flame, the ribs and roof being covered with coked dust. The indications here also point to the conclusion that the forces were dammed back by the stone drift, which probably gave the flame more time for action. At the fifth, sixth, seventh and eighth cross entries the doors on the west were blown in, and down the main entry, toward daylight; while those on the opposite side were thrown eastward, toward the faces of the workings. The door of the eighth west entry was found several hundred feet down the main entry, and the six men found there, as well as the cars wrecked there, evidenced a violent force from the west, coming down this eighth cross entry. On the main entry west, five bodies were found badly mangled and burned. As this point is near the beginning of the stone drift, the force and heat were probably concentrated by the contracted area inside, but had room to expand through the old workings toward the outcrop, before reaching the entrance. Enormous forces were exerted down the nineteenth and twentieth rooms, coming from the direction of No. 4, with which they were connected by break-throughs. The tracks and everything movable, including a Harrison mining machine, were thrown out of these rooms against the rib of No. 5 entry, where the force seems to have been divided, one part being directed toward the face of the entry, the other toward the main entry. There are only two ways of accounting for this curious reversal of forces. One is, by supposing that a local pocket of gas was fired, and followed the line of least resistance, which must have been toward No. 5, possibly on account of the stone drift; and the other is the assumption of a secondary or later explosion, due to either a pocket of fire-damp, or of carbon monoxide, known as "white-damp" by miners, which might have been produced by reduction of the carbon dioxide, or "black-damp," passing over the red-hot carbon, of the presence of which there is ample evidence in both the fourth and the fifth entries. A molecule of carbon dioxide (CO_2), in passing over red-hot carbon (in this case, coke) takes up another atom of carbon in chemical combination, making two molecules of carbon monox-

ide (2CO), which is a combustible (and when mixed with air before ignition, an explosive) gas, being the principal constituent of the furnace gases used for heating the blast and boilers at all modern iron blast furnaces. The latter alternative strikes me as the more reasonable, as the partial vacuum, created by the first explosion, would have directed the line of least resistance from these rooms inward, or toward No. 5, a fact hard to account for without such a partial vacuum. As a further evidence that there was little resistance from within, this force seems to have been expended to the east, before reaching the face of the entry, near which a car was found standing on the track, with a sheet of white paper stuck in the side, neither of which had been disturbed; consequently the direction of least resistance must have been westward and inward.

Entries six and seven east, as already observed, had their doors blown eastward, showing that the force originated in or beyond the main entry, and not in these east workings, in which there is little evidence of violent disturbance, though coked dust on the walls and roof shows flame and heat. No. 8 east was little disturbed by heat or force, especially near the faces of the workings; and I am confident that the explosion did not originate in these or any other workings east of the main entry. The body of a man was found on No. 8 east, in the mouth of the fifth room, to reach which he must have passed within sight and hearing of the fire boss, who was found only about 100 feet distant, on the same entry, at the seventh room and fifth break-through. It is evident that the latter had found gas in the face of this entry, as he had raised the end of the air pipe and turned on the air, to drive it out; but it is reasonable to assume that he did not regard it as dangerous, or he would not have permitted the presence of the three men found so near, all of whom he probably saw or heard enter. I was informed that none of these four men were burnt or disfigured, and from descriptions of their position and condition, I infer that they must have been killed by the after-damp resulting from the explosion.

The faces of the main, parallel and cross entries No. 9 all show the effects of considerable force, coming up the west parallel from No. 8; and the intersection of this parallel with No. 9 west is indicated as the point at which the greatest force of the explosion was exerted within the mine. On entry No. 8 west the waves of force were projected in every direction; the track and timbers having been thrown east and west on the entry, and north and south through the rooms and air ways. As no other point in the mine exhibited like conditions, it is reasonable to assume this as the origin of the explosion; and, in my opinion, the gas was first lighted at or near this point. Everything was swept through this room to No. 7 entry with great violence; the indications being that the forces directed south through this room, east to the main entry, and north up the parallel air way, were about equal, while that along the entry to the west was breeched by the faces of the workings, distant only a few hundred feet in that direction. All indications in the west workings point to the movements of the forces from that point to daylight along the lines of least resistance, through rooms, air ways, and main entry, and along No. 5 west, in both directions; eastward to the main entry, and westward to the Rush Run mine. At a point on No. 7 west, a boy was found in line of the room already referred to, leading from No. 8, and I saw a pool of blood and brains where his head had rested. Near by another boy was found. The workings being extensive, there were large areas to receive the expanded gases; and a considerable portion of the forces had evidently been thus dissipated by the

time they reached No. 5 cross entry; otherwise, the fan would probably have been demolished.

CAUSE AND ORIGIN.

The primary cause of the explosion was evidently fire-damp, a carburetted hydrogen gas, the principal constituent of which is CH₄, or marsh gas. We know that a mechanical mixture of more than one part of this gas to fourteen of atmospheric air is explosive—the most explosive proportion being about 1:9.5. With more than fifteen or less than five parts of air to one of gas, the mixture is not explosive; but by reason of the diffusion of gases, this mixture must always be found variable where there is any ventilation or circulation of air. As all coal will give off at least its own volume of gas (and some coal much more), its presence is easily accounted for, and would be detected in all coal mines but for its tendency to escape through every crack and crevice toward higher outlets, owing to its density being less than that of air. Taking this density of air as unity, that of methane, or marsh gas, is 0.559, or a little more than one-half as great. If sufficient time is allowed, air and fire-damp will make a complete mechanical mixture, according to the law of diffusion of gases; but the latter is usually found at the top in mine workings, owing to lack of time for complete diffusion, before the gas is removed by natural or artificial ventilation. In coal mines above water level, where the covering can crack, or break, fire damp is rarely noticed in workings within less than a mile of the escarpment, or outcrop. Within this limit it is carried off by the usual methods of ventilation, assisted by the movement of cars, the upward escape by levity, through crevices, etc.; but below water level, or where the lines of escarpment embrace larger areas, with a heavy, unyielding cover, gas may usually be expected to give more or less trouble.

At Red Ash there is no escarpment northward or westward, in the direction of the workings, for many miles, and the overlying rocks are too massive to break, in consequence of which gas had been found within 4,000 feet of the entrance, and was probably given off freely in all the workings inside, and including the eighth cross entry. During a period when the fan was idle on Monday night there must have been in these workings an accumulation of gas and a mixture of it with air, which by the operation of the fan on Tuesday morning was started back in the return air course, where it was met by a naked light on the eighth west entry near the main return air way. About sufficient time (thirty minutes) had elapsed since the starting of the fan for the air to travel down the intake, 4,000 feet of the main entry, and back on the return to the point indicated—the total travel being about 4,500 feet, which would make the velocity about 150 feet per minute, and (taking the section of main entry at seventy-two square feet) would be equivalent to a volume of nearly 10,800 cubic feet per minute—probably as much, or more than as much, as the fan was doing at the start.

The theoretical requirements for ventilation given by Andre, in his "Practical Treatise on Coal Mining," a standard authority for the world, are twenty-four cubic feet of air per minute for each man and light, seventy-two for each horse, 192 for each pound of powder burned, 100 for each cubic foot of coal mined, and one cubic foot per minute for each square yard of coal surface in the mine.

Assuming that 150 men were employed underground in the Red Ash colliery, with fifteen horses or mules; that twelve pounds of powder were burned per hour, and eighteen cubic feet of coal were mined per minute (or 400 tons in ten hours); and that 1,000 square yards of coal sur-

face was exposed, a simple calculation will show that 10,000 cubic feet of air per minute would be required to satisfy Andre's requirements. But this would leave no factor of safety, whereas such a factor, of two to five—according to actual tests of the amount of gas produced in the mine—should be allowed.

From the effects observed, I think the dust had little or no influence on the primary cause, though it must necessarily play an important part in all explosions, when the gas is once ignited, by adding to the forces evolved. My impression is that the boy found on No. 7 west met the gas with a naked light on No. 8 west, on its return to the fan, and was blown down the room to the point where his remains were found. It is possible that one of the men found on the main entry may have lighted the gas in the return west air way at or near its intersection with No. 8 cross entry, in which event the force exerted at that point was sufficient to have blown him to where these bodies were found. From all the evidence, however, I am inclined to the opinion that the gas was lighted by the boy found on No. 7 west, as he was in a straight and direct line from the evident point of ignition, indicated by circles of force, like the ripples from a stone thrown into a pond of still water; and at every other point in the mine the forces can be traced to this origin as the center from which the waves emanated. I was satisfied, from all I could see and hear, that the general plan and conduct of this mine were fully up to the standard of the New River district, and above the average in many respects. The presence of gas in dangerous quantities, however, was not fully realized, consequently some of the expense and precautions for a highly gaseous mine were omitted. Nor could the precautions necessary for such conditions have been insituted, in my opinion, without a loss at the prevailing market prices, as the additional costs would necessarily have exceeded the profits.

Both the operators and operatives of this district are unaccustomed to gaseous mines, and both must be educated to the requirements. The operator may comply strictly with every requirement, regardless of cost, yet the ignorance or carelessness of a single operative may bring about disaster without warning, and none may live to tell the tale. Many such cases are on record, and nothing but time, strict attention, and experience will provide an adequate remedy.

As already observed, I did not measure the volume of air handled by the fan during my visit. Under the conditions as I understand them, however, the capacity of the fan would have had little effect upon the result, as it was not running more than thirty minutes before the explosion. The larger the capacity of the fan, the sooner the gases would have been drawn out and the mine rendered safe; but the danger existed as long as they remained in the return, where they were liable to ignition anywhere between the fan and the working faces where they had been generated or accumulated.*

The Mining Expert—An Australian View.

Few men have been made the subject of more all-round abuse than the mining expert. In this respect he has out-rivaled the surgeon and the physician, of whose respective professions it has been sarcastically said: "Surgery is a science founded on assumption and demonstrated by manslaughter;" "the practice of medicine in an art the merit of which consists in amusing the patient while Nature effects the cure." The

popular opinion of the mining expert has been expressed with even more bluntness and bitterness than is embodied in these biting sarcasms, for while the sting has been retained, the epigrammatic humor has in many cases been omitted. Everyone who has suffered, or who has supposed he has suffered, through his agency has taken the liberty to roundly abuse him. He has been ridiculed, contemned, and derided with unbridled license. Not only has his skill been scoffed at, but his very veracity has been impeached in the well-known formula: "The liar, the —— liar; the mining expert;" and yet the mining expert, properly so called, is a most worthy, a most useful, and a most estimable public servant. The whole matter lies within the compass of that limitation "properly so called," for, unfortunately, like those of the lawyer and the doctor, the profession of the mining expert is discredited and disgraced by ignorant quacks and impudent charlatans, from whose pernicious practices they and the public are not protected as are the practitioners and the public in the cases first named. If an unqualified man ventures to practice law or physic he does so at his personal peril. If an unqualified man practices as a mining expert he does so without let or hindrance. As in the cases of the quacks first named, the greater the ignorance of the mining empiric the more inflated his pretensions. He compensates for his lack of knowledge by his abundance of audacity, and with no better equipment than the terminology or mere patter of the profession on which he preys, he pronounces positive opinions of the most extravagant character on propositions which the competent man would deal with very differently. The great mischief of the whole matter is that the unscrupulous "expert" frequently finds equally unscrupulous employers. There are dishonest men whom it suits to employ dishonest agents as their accomplices in working a confidence trick on the public, and it is by these two classes that a profession which calls for a high standard of scientific ability, allied to a wide range of practical experience, is brought into disrepute. This, however, is not fair to the mining expert, who is thus made to pay penalty for the public inability to distinguish between the bogus and the genuine. As we have said, the mining expert is for the investing public a necessary guide, and in the great majority of cases his guidance is reliable. But to justify his title he must be a man of liberal education and varied scientific attainments. He must be a surveyor, a geologist, a mineralogist, and a metallurgist. He must have a capable knowledge of mining work and conditions, and above all he must be a competent mining engineer. The qualifications first named will enable him to form estimates as to the character, approximate quantity, and probable value of ore contents, while those last mentioned are necessary to his calculations respecting the nature and cost of working the difficulties in the way, the methods by which they can be overcome, and the extent of the ore body upon which it is proposed to operate. Such a man is a mining expert, properly so called, and assuming that with his other qualifications he is gifted with that discretion which begets a temperance in estimate and expression, he is not only entitled to respect and esteem, but to the people contemplating a big mining enterprise his worth is almost incalculable. The value of the first-class man has been demonstrated and suitably acknowledged in connection with every great mining enterprise throughout Australasia, such as Mount Lyell, Mount Bischoff, Broken Hill, Great Boulder, and Mount Morgan. Unfortunately it is impossible to set a special brand upon the capables which would distinguish them from the incapables, because appropriation of

*Prepared for Canadian meeting Am. Inst. M. E., August, 1900.

alphabetic distinctions cannot be controlled by law. A man may write M. E. after his name, or any other grouping of letters professedly certifying to his capacity in mining engineering or its allied branches of study, who has never made the least acquaintance with either. In the great majority of cases experience alone can expose the fraud, but when this is done the victims would act more wisely and more fairly by blaming their own gullibility than by charging the faults of its parasites to a whole profession, in pouring out the vitals of their scornful wrath upon the mining expert.—Australian Mining Standard.

Death of Marcus Daly.

Marcus Daly, Montana's famous copper mine owner, died on the morning of Monday, November 12, at the Hotel Netherlands, New York City, after an illness of two months. When he returned from Europe early in September he was suffering from a complication of diseases and his recovery has since been considered impossible. It is said that the fatal malady was contracted several years ago, owing to Mr. Daly's constant presence in his mines and smelters, where he supervised the work of his men. Mr. Daly was always an indefatigable worker, and he considered that his personal attention was practically necessary for the successful treatment of his properties. His heart was weakened by his unceasing labor in high altitudes and in the arsenic-permeated atmosphere of the smelters.

It is said that Mr. Daly came to New York for treatment some time ago, and in a characteristic manner went to three specialists in turn, requesting their advice as to forms of treatment without informing any one that he had consulted others. From all three he received the same advice. After remaining under treatment for some time his health improved and he finally went abroad. He took the baths at Nauheim, much against the advice of his doctors, and it seems that in his case the baths were too stimulating, and that although temporarily improved, Mr. Daly soon grew worse.

Marcus Daly began his life work as a miner with pick and shovel, and ended it as the possessor of a fortune estimated at from fifteen to thirty millions. He was born in County Cavan, Ireland, in 1842, but came to this country at the age of thirteen. He worked about the mines at Butte, but frequently took a week off, prospecting, and improved his time so well that when J. B. Haggin wanted to buy a silver mine Daly secured the Anaconda property for him for \$35,000. The mine was a good silver producer, but its enormous value later came when it was found to be a wonderful copper producer, and it made Haggin, Daly and others multi-millionaires. This was the beginning of Butte as a copper centre, and the first developers bought all the mines they could secure. Later they built a spur railroad to Anaconda, and the mines now produce more than one-fourth of the world's copper supply.

Mr. Daly early in his days of wealth developed a passion for horse racing, and in his time owned some of the finest horses on the American turf, including Hamburg, Tammany, Senator Grady, and others. He had a breeding farm in the Bitter Root valley, and was often seen at Eastern race meets. A few years ago he quarreled with William A. Clark, formerly his business partner, over some land near Butte which Daly and Clark purchased together. During Clark's absence in Europe Daly conceived the plan of building the works of the Anaconda Mining Company on the land. When Clark came home he sued Daly and obtained a judgment for \$225,000 for his interest in the land. Daly swore that he would get even with Clark, and soon found his opportunity in the entrance of Clark into politics. Montana was

then a Territory, with a Democratic majority. Clark was a candidate on the Democratic ticket for Congressional Delegate, but Daly threw his influence to the Republican side, and Clark was defeated by Thomas H. Carter.

When Montana became a State in 1889, Mr. Clark was put forward by his party in the Legislature for the United States Senate, but was again defeated, as he was in 1893. The next fight was for the location of the State capital; then they again contested the Senatorship two years ago, and though Clark won he was disgraced in the eyes of most men, for Daly carried the fight to the United States Senate, where he charged bribery on a wholesale scale by his enemy. The Senate unseated Clark. At this year's election, with Daly on his deathbed, the Montana opposition to Clark was disorganized.

Mr. Daly's first work in California was not in the mines, but on a farm. He earned enough money digging potatoes near San Francisco to take him to the diggings.

Once at the mines he worked like a Trojan. Promotion was rapid. Hard work and good luck joined forces to help him along, and the discovery of the Comstock lode found him in Nevada—a prosperous prospector, no longer a boy, an expert on ores, and a self-educated mining engineer. From the time of his first arrival at the "diggings" he had studied as he worked, and the result was that before long he knew as much about the mining facilities of the West as any of those who had lived there long before him. He had mastered the technicalities of the mining business, too, and was a skillful assayer.

Daly was made foreman of the Comstock mine by the syndicate which controlled it. This combination was the one headed by Mackay, Flood and O'Brien, all of whom the young man had met in his wandering through the various mining sections. In the position they gave him he worked until he was engaged by the Walker brothers to act as a mining expert in the neighborhood of Salt Lake City, Utah. After staying there for several years he was sent by his employers to examine the Alice mine in Montana.

The stock in this mine had fallen low, but the Walker brothers, having conceived the idea that it would rise again, instructed their representative to get into it and learn all about it. This was no easy task. The owners maintained great secrecy in running the mine and allowed no strangers to enter it.

Daly, upon reaching Butte, where the mine was located, posed as a common miner. In order to conceal the real object of his visit he even went so far as to feign penury. Before he began to do this, however, he obtained quarters at the Continental Hotel. At the end of the first week the landlord asked him to pay his bill, whereupon the guest replied:

"You get me a job, and then I'll pay you." The landlord managed to secure the young man a job in the Alice.

For three weeks he staid in the mine, working as a common laborer, and incidentally making a minute examination of the property. When he had learned all about it he resigned his position, paid his hotel bill, and went back to make a report to his employers. Before he departed the innkeeper remarked:

"You are too particular about your work and too easy with your eating."

A short while afterward Daly returned to Butte as manager of the Alice mine, the Walker brothers having bought it. While there he saved money and invested it in mining stocks. Among his purchases was the Anaconda mine. At that time this mine was thought to produce only silver, but after the shaft had been bored down 120 feet a rich copper vein was found, and before long it

became known that Marcus Daly controlled the largest bed of that metal ever discovered. A company was organized to work the mine, and it included, among others, the late Senator Hearst and J. B. Haggin, but the original purchaser of the mine retained a controlling interest. It was not long before millions of dollars began to pour into the pockets of the stockholders.

The Anaconda mine is near Butte, and to-day the worth of the property is so fabulous that nobody can exactly estimate it in figures. Some mathematical friend has calculated that the lumber used in the main shaft and branches during a single month would build a board walk two feet wide from Washington to Philadelphia, and it is said that a hundred cords of wood are eaten up every day by the gigantic furnace that gives motion to the machinery in the works. The daily output of the mine is upward of 3,000 tons of ore. For smelting the ore is transported to Anaconda, a distance of thirty-seven miles, and the smelting works cover a whole mountain side, the area occupied by them being eighty acres. Besides the immense amount of copper produced in the mine, there is much gold and silver—enough, it is said, to defray all the expenses of smelting the copper.

It has been estimated that the property controlled by Mr. Daly in Montana was worth at least \$25,000,000. How much he owned outside of that nobody knew. Of the Anaconda mine his was more than one-fourth the total stock. A minimum value placed on that property a few years ago was \$35,000,000. The monthly payroll of the mine is more than \$160,000, and the coal used in working it costs \$50,000 a month. Under Mr. Daly's orders when, before his illness, he was the active head of the mine, there were 10,000 men on the payrolls. That number does not include many more thousands in the various lumber mills and factories of different kinds which he owned.

Much of Mr. Daly's time in late years was passed in New York, where he staid at the Hotel Netherland. The main office of the Anaconda Copper Mining Co., of which he was president, is 52 Broadway. Mr. Daly was a member of the Manhattan Club.

Mr. Daly was also president of the Amalgamated Copper Co. and was interested in the United Metals Selling Co.

Aluminum vs. Copper.

The article by Nikola Tesla which recently appeared in the Century Magazine containing the prediction that the copper industry would soon be annihilated by the aluminium industry has not ceased to attract the attention of scientists and miners. A recent contribution to the controversy on the subject is the opinion of Professor John Trowbridge which has just appeared in the Independent. Public Opinion has summarized Professor Trowbridge's article as follows:

Although aluminum does not oxidize in the atmosphere, yet an electrolytic action sets in when it is brought in contact with other metals, especially iron and steel. It deteriorates rapidly in salt water, and can not, therefore, be used for sheathing yachts. Commercial aluminum is generally impure, and is acted upon by moisture, especially if there is salt present. In regard to weight and strength it can not compete in price with various kinds of wood. It is not so easily worked, and is not made so homogeneous as steel. In the electrical industries, however, its prospects seem to be higher than in other industries, when it is brought into competition with steel, iron, and copper. We hear occasionally of the employment of aluminum on a large scale in such industries. At Niagara Falls great conductors of aluminum are used to transmit elec-

trical currents from the power-house to the works. These conductors are aluminium bars twenty-five feet long, six inches broad, and one-quarter of an inch thick—four of these are riveted together at the ends, and each group of bars is connected to aluminium cables—the core of each cable is about one and one-quarter inches in diameter. The amount of aluminium in the conductors is 22,000 pounds. The same work in copper would require 48,000 pounds. The conductivity of the aluminium compared with copper is sixty-three per cent, but for the same weight it is more than double. Aluminium cables require more insulation, but enable longer spaces to be used, thus reducing the number of poles and insulators.

A curious obstacle, however, exists at present to its use as a substitute for copper; this resides in the difficulty of soldering and brazing two pieces of the metal together. Many solders or fluxes are described for accomplishing this connection, but they can not be said to be commercially practicable. The necessity of such an art of connection is imperative in electrical industries. Let us consider the overhead wires in the trolley system. The pieces of copper wire which are employed are only a few hundred feet in length, and the railroad systems extend over many miles. In order to transmit the electrical current without great loss, the ends of the copper wires must be perfectly joined by soldering or brazing. The same can be said of long-distance telephone circuits. It is true that iron telegraph wires are often twisted together without solder, but the advance in electrical engineering demands better connections than such mechanical ones. The need of a method of soldering seems a small matter, and one might expect that invention would speedily supply it; but the need has always existed, and the readiness with which aluminium can be melted seems to offer a great barrier to this method of connection.

Although aluminium may be used for overhead telegraph lines, it seems to be effectually barred from competition with copper in cable work, for in order to compete in electrical conductivity with copper an aluminium wire must have nearly twice the section of a copper wire of the same conductivity. This increases the size of the cables and also increases the electrical capacity, which is detrimental to the speed and proper transmission of electrical waves. In general the use of aluminium wire for copper would lead to the greater size of apparatus, the conducting parts would have to be approximately twice as big. The element of labor, in working the material in comparison with a similar employment in the case of copper and brass, would have to be considered. No mechanic would work with aluminium if he could take copper or brass. Aluminium can be said to be increasing in use, but it is not yet a dangerous competitor of copper.

Natural Gas in Colorado.

Mining engineers and geologists have been giving much attention to the recent discoveries of oil in the western part of Routt county, Colo. The successful development of these oil fields is confidently predicted. According to the Denver Times, a prominent Colorado mining engineer who made careful examinations of the formations of Garfield, Rio Blanco and Routt counties many years ago, says that it is destined to become one of the richest portions of Colorado. He found oil where the operators are now working more than ten years ago, and says that gilsonite, natural gas and other forms of carbon exist there in unknown quantities, and have been proved in several instances. On the divide between the Grand and the Gunnison rivers near the head of

Buzzard's creek, Garfield county, about twenty-five miles south of Aspen, natural gas was found over a very large area. The gas was found escaping through the crevices of the rocks on declivities, where the cliffs had been subjected to erosions, and an examination of the formation disclosed the fact that it was overlaid with a deposit of shale impervious to the gas. A pit was dug in this shale to the depth of about ten feet, when the flow of gas became so strong that the men were obliged to come out of the pit. One of the men lighted a bunch of brush and threw it into the pit, causing the gas to ignite with an explosion of such force that the boards of the party, who were a little distance from the hole, were singed.

Ingersoll-Sergeant Drills at Paris.

One of the most successful American exhibits at the Paris Exposition was that of the Ingersoll-Sergeant Drill Co. of New York City. This company made a remarkable display of its air compressors and mining, tunnelling and quarrying machinery. In the mining machinery exhibit especial attention was attracted by a large machine termed the track-channeler—a machine running on a track and intended for cutting a long, narrow, vertical slot in any kind of rock. Thirty-five of these machines were in use on the Chicago Drainage Canal, where for miles they cut through hard rock to a depth of from twenty-



INGERSOLL-SERGEANT COMPRESSOR AT THE EXPOSITION.

An effort was made to put out the fire with brush, but was unsuccessful, and they left it burning.

Another place where natural gas is found over an immense area is near the head of Piceance creek, in the Book cliffs. Below the rim rock of these cliffs are found chunks of gilsonite of excellent quality, worn like pebbles, from the size of a fist to as large as a man's head, which have been washed up and are imbedded in the formation, and above the rim rock is an immense quantity of bituminous sandstone which contains fifty-six per cent of volatile, combustible matter, and four per cent fixed carbon. This rock takes fire easily and burns with a strong flame and is frequently used as fuel by residents of the vicinity. Further down on Piceance creek are fissure veins of gilsonite of the purest quality. The entire country is extremely rich in carboniferous material, which will some day be utilized. At present it is too far away from thickly settled communities to justify development, but the opening of the oil fields is expected to have such an important influence upon the settlement of the country that it is believed that the time is not far distant when all of these products will find a profitable market.

Copper Industry Thriving.

For the first nine months of the present year this country's production of copper amounted to 400,000,000 pounds. Placing the value at seventeen cents a pound, the product was worth \$16,000,000, and assuming that the cost of production is eight cents a pound, the profits to the producers for this period was \$36,000,000.

For the first nine months of 1898 the production of copper in the United States amounted to 350,000,000 pounds, for which an average of twelve cents per pound was received, or \$12,000,000. Net profits to the producing mines may be put down at \$15,000,000.

The profits for the first nine months this year are therefore 140 per cent above those received two years ago. Six years ago the price of copper was as low as nine cents, while ten and one-quarter cents marked the highest point in that year.

four to thirty-six feet in three steps of twelve feet each. The machine consists of a fair-sized vertical tubular boiler mounted on a heavy frame which is in turn supported by four flanged wheels running on a track made in sections. On one side, and supported on a substantial bracket frame are the cylinder guides, valves, and controlling mechanism. Steam passes over from the boiler through flexible connections to the cylinder, and causes the piston to reciprocate, rapidly raising and driving down the cutting bars which are clamped to the guide chuck on the end of the piston rod.

The cutting points are under absolute control of the operator, who can strike hard, rapid blows or light slow ones, or he can cause the cutting to occur at the upper or lower part of the stroke. The single lever which shifts the machine along the track is also within easy reach, as are also all the lubricators, adjustments, etc. Machines of this type and make have cut as much as 475 square feet in ten hours, although the ave age on large work is from 160 to 175 square feet for the same time.

Another interesting machine intended for quarries and places where the output would not warrant the expense of the large machine just described is called the bar channeler. Briefly, it consists of a frame mounted on four adjustable legs. This frame has two long cylindrical slides, on which are mounted a carriage holding a powerful air or steam drill and a small engine which feeds the carriage back and forth along the frame. In operation, the machine is set up, the frame given the desired inclination, which may be varied from vertical through all angles to horizontal, and the drill and shifting mechanism is started. This combination of rapid and powerful blows from the cutting points, and the side movement of the feed result in a narrow slot the length of the frame and seven and a half feet deep, which is so smooth that stone cut this way needs only facing to be ready for use in buildings or for other purposes.

The standard rock drills, of which the company had several of its small and medium sizes set up

for operation, were also of interest. Described in a general way, these drills have a cylinder mounted in a guide frame and provided with a screw, which is used in operation to advance the cylinder as the drill cuts the rock. In the cylinder is a piston which forms part of the piston rod and chuck or device for holding the bit or cutting tool. There is also a special cylindrical slide valve which admits air to one or the other ends of the cylinder at the proper instant, and this causes the piston rod and chuck holding the drill bit to reciprocate rapidly. The drills are mounted on the Sergeant universal tripod, which permits a rapid adjustment in any direction and which, while exceedingly light in weight, is unusually rigid, owing to the method of construction and clamping of the parts. Other forms of mountings for shafts and tunnels are also shown. This company yearly produces over 2,500 of these drills of different sizes and it has already sold over 30,000 drills of all sorts.

A pneumatic coal cutter, of which the company is turning out about 1,000 each year, and a type which is a novelty in Europe, consists of a substantial cylinder mounted on wheels and provided with two handles, was also shown. In a general

The Steel Castings Industry of To-Day.

The Changes Science and Industry Have Wrought in Fifty Years—The Special Steels.

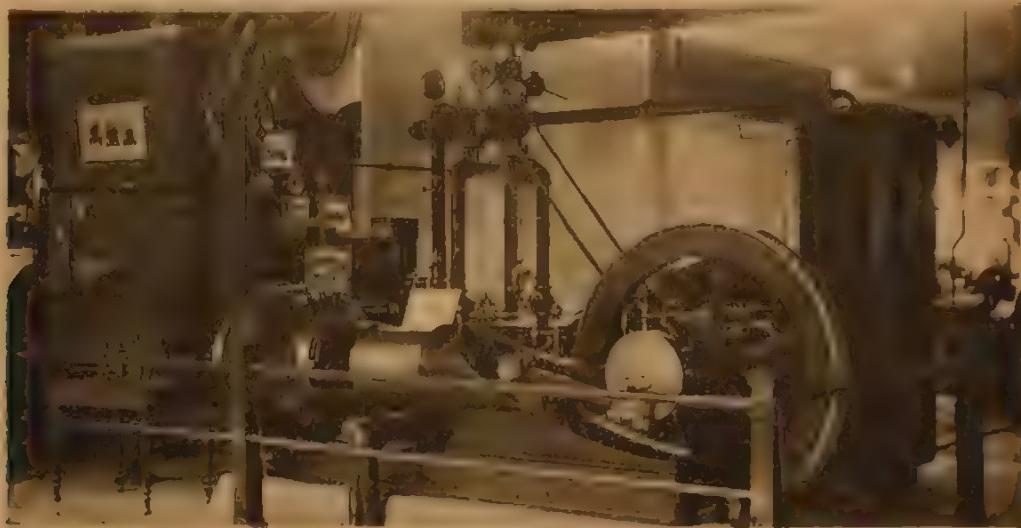
By M. A. Tison.

It is fifty years since the first steel castings were made, but until quite recently the production was very limited, owing to the difficulty of obtaining the liquid metal in sufficient quantity for making very large castings. Attempts were made at the time of their first appearance to utilize the Bessemer converter and the open-hearth furnace, but not with good results. About 1885 M. Robert invented his converter with side blast, which, applied to the casting of steel, enabled the works to produce complicated castings of excellent quality, and, in fact, created a new industry, for the sphere of their utility has been extending over since. Many difficulties have, however, had to be surmounted by the steel founders, and it is only in virtue of their perseverance and ingenuity that the new craft has become a success. The fusing point of steel is very high, ranging from 1,450 degrees to 1,600 degrees, and in working the metal higher temperatures still are employed. This high

With the facility of obtaining a regular supply of metal, the steel founders proceeded to improve their plants; the old cranes were replaced by electrical or steam lifting machinery of a power of thirty, fifty and a hundred tons; cold saws, compressed-air machine tools, and electrical welding, for remedying slight superficial defects, were introduced; and lastly, as denoting the great extension of the industry, the molding machine was adopted in steel foundries. The converters, with lateral blast, supplying steel at a very high temperature—which can be stored without becoming too cold to run into the mold—enables the founder to turn out, with the aid of the machine worked by two men, 600 to 1,000 kilos per day of complicated castings weighing from five to twenty kilos each.

IMPROVEMENTS IN PROCESS AND PRODUCT.

Another great improvement effected is the subjecting the pieces during annealing to a sudden cooling or tempering in air, which improves the quality of the steel. The castings are heated to 1,000 degrees, and then suddenly exposed to air at from 1,000 to 600 degrees. Their power to resist shocks is thereby vastly increased, and they are more elastic and more tough. Improvements in



SECTION OF THE INGERSOLL-SERGEANT DRILL CO.'S EXHIBIT AT PARIS

way, this machine may be compared with a wheelbarrow from the front of which projects the cutting tool. The operator holds the handles and guides the machine forward or from side to side, and thus cuts under the coal, which is then broken down. The claims for this type are many, and not the least important of these is its extreme simplicity, rapid and large output, the introduction of an appreciable amount of clean, fresh air into the heading and the absence of powdering, which always results from the use of milling or saw cutters. The machine is very compact and light, and is inexpensive.

A variety of small parts, such as drills, drill-sharpening tools, cutters, clamps, etc., complete this exhibit, which, as already stated, is the most extensive mining and air compressor exhibit from the United States, if not from any country exhibiting at the Paris Exposition.

This company also received the only Grand Prix awarded to any manufacturer in its line. It received the following prizes. Grand Prix, group XI, class 63, mining apparatus; gold medal, group VI, class 21, compressors; silver medal, group VI, class 28, models of apparatus used on Chilango Drainage Canal; honorable mention, group IV, class 20, small motors on chandeliers; various motors.

fusing point, and the contraction which steel undergoes when it cools, were the source of much vexation to the steel founder. This shrinkage amounts to from fifteen to eighteen, or even twenty mm. per meter, according to the heat and composition. If the mold offers too great a resistance to this contraction, there is risk of the casting cracking or becoming crooked. The third source of anxiety was the appearance of flaws, because it is necessary that a steel casting should be perfectly sound.

OLD DIFFICULTIES OVERCOME

The united efforts of the manufacturers of steel, and of the founders, have, however, overcome every difficulty. After many experiments it was discovered how to prepare a suitable refractory sand, capable of withstanding the intense heat of the molten metal. It is composed of quartz, sand, silica brick powdered, and other refractory material, and it is rendered plastic by the addition of clay. The great shrinkage that steel experiences on cooling has most severely taxed the resources of the founder, and he has only been able to remedy its consequences by a number of contrivances, such as the introduction of ribs to strengthen dangerous parts, the early removal of the core which opposes the contraction of the metal, the releasing the casting while it is still red hot, etc.

the construction of the crucible furnace and the higher temperature now obtainable, enable very delicate and malleable castings to be at the present time made with a metal containing a much lower percentage of carbon than was possible formerly. Sundry correctives to the steel, such as aluminum, nickel, etc., are now added universally. The ameliorations made in the open-hearth furnace during the last ten years have greatly assisted the founder. The temperature, quality, and purity of the metal have been improved. And metal is no longer necessarily hard as formerly. Basic furnaces have now been brought to such perfection that with their produce excellent castings can be made, which ten years ago was impossible. The judicious employment of aluminum is responsible for this improvement, so that basic steel is in many cases now preferred to acid steel. In both kinds of metals the hardening constituents—carbon, manganese and silicon—have been diminished. The following is the average composition of open-hearth foundry steel:

Carbon	0.25 to 0.50 per cent.
Manganese	1.00 to 0.50 per cent.
Silicon	0.20 to 0.45 per cent.

The increased employment of cast steel has led to the construction of furnaces of a capacity of fifty tons which are as rollable as those of twenty-

one tons, and they are specially devoted to the production of steel for castings, and only rarely are ingots run from them. The converter, with the lateral blast of M. Robert, or imitations of the same, have now come into general use, and seem to satisfy all the remaining requirements of the steel founder. Owing to the peculiar arrangements of the tuyeres, the output can be varied from 800 to 2,000 kilos, or from 3,000 to 6,000 kilos, in the two types of the apparatus in use. The heating of the same is easy and inexpensive. The metal is milder than that produced by the Martin furnace, even when not employing any other than ordinary. It possesses great power of resisting shocks and a degree of elasticity which attains 110 kilos per square millimetre. It is, therefore, naturally well adapted for war material and marine purposes. Nickel steel with varying proportions of the first-named metal is now also largely manufactured for armor plates, artillery, etc.

THE SPECIAL STEELS.

The first special steels which were introduced, such as chrome and manganese steel, did not produce any greater difficulties to working than ordinary steel. The conditions in forging, temper-

The Future of Copper Mining.

Production Stimulated by High Prices—Will the Supply Keep Up With the Demand?

The difference between the iron and copper mining industries is a radical one, says a writer in the Seattle Times, much as the two lines of mining resemble each other at first sight. The iron trade has been aptly called the barometer of American business interests, and like the real barometer with its column of mercury, the fluctuations are numerous, and at times sudden and severe. The average iron mine can be reopened on short notice after long idleness, but the reopening of a copper mine is a matter of years. The iron miner must adjust his efforts to the requirements of the market for the near future, while the producer of copper is necessarily working with a view to the general average of conditions for a decade to come, being unable to adjust his efforts as a whole to the minor fluctuations of the copper market. The big mines can, of course, adjust production to immediate demand to some extent, but the fluctuations in output of even the largest

future of the copper market in five or ten years is a matter of conjecture. The high price is stimulating production, and while, from the peculiar conditions surrounding copper mining, it is impossible to open new mines rapidly, the nature of the business is such that a strong stimulus once applied is more lasting in its effects than in industries where supply can more readily respond to demand.

THE WORLD'S GROWING DEMAND

There are many good copper mines being opened throughout the Union, and many more new mines in other countries. In a few years the effect of renewed effort in copper mining over the entire globe must be plainly felt in largely increased production. This much is certain, and what the effect of doubled production will be within six or seven years must depend almost wholly upon the progress of electrical development. Should the utilization of electricity proceed at its present rapid rate of increase both in America and abroad, the world's supply of copper in 1907, which will probably be nearly double the production of 1900, will not more than meet



AN INGERSOLL-SERGEANT TRACK CHANNERLER AT WORK.

ing, and annealing were much the same as in carbon steel. Later varieties, notably those with a large admixture of nickel, owing to their extraordinary properties, presented difficulties of a formidable nature. Certain steels at the temperature at which carbon steel can be forged, became hard. In others, the process of annealing seems to have an action the very reverse of that it has on ordinary steel, and so forth. It required innumerable experiments and much scientific research to arrive at suitable methods of working the new alloys. According to the theory of Messrs. Carlo, steel should be tempered when it is in a feeble magnetic condition at a high temperature. The determination of the point of magnetic transformation would be sufficient, therefore, in any case to determine the temperature suitable for tempering. Before the new alloys, notably the nickel steel, could be introduced into practical industry, many difficulties had to be overcome, owing to their extreme hardness, which the drills, the cutters of the planing machine, etc., could not attack. However, by annealing the metal and the use of specially made tools, and by working at a reduced speed, the trouble has been overcome. The metal adopted at the works of Impy for machine tools is chrome tungsten steel, tempered.*

mines are comparatively slight. The stimulus of very high prices enjoyed by the Lake Superior copper mines for the past two years has resulted in increasing the annual production of the red metal less than ten per cent per annum. John Stanton of New York, the veteran authority on the American copper trade, estimates the increase of product of copper for the entire United States at no more than ten per cent for the year 1900, the increase for the first half of the year being but nine per cent. This increase is barely sufficient to provide for actual requirements, and the increased production of foreign lands is scarcely as great as the average in this country.

Despite the many flourishes of trumpets and the tens of thousands of dollars expended in the columns of the press, advertising the numerous Calumet and Hecla in embryo, which were to make their shareholders wealthy on small investments, the production of all the new mines, together with the increased output of all the old mines, did not exceed ten per cent last year, will not exceed the same amount this year and probably will show no greater gain in 1901. The immediate future of the copper market seems assured. With a strong and steady demand for all the copper that can be mined the price of the metal, high though it may be, is supported by the logic of demand and supply. What may be

the requirements. Should, however, there be a marked falling off in electrical construction, either in the United States or Europe, or in both, there will be hard times in store for many of the mines, and eight-cent copper is probable for a time. The best mines of Michigan, Montana and Arizona are making copper at six to nine cents per pound, and the cost of production can be materially cut if the necessity arrives.

The mines are now earning larger profits than ever before in their history, and are paying the highest scale of wages, while expenditure is not being stinted in any direction. This policy of lavish expenditure in prosperous times is condoned by many short-sighted and greedy shareholders, who grumble because all of the vast profits are not paid out in dividends as rapidly as earned, but the well-managed mines are putting themselves in splendid position for withstanding the slings and arrows of outrageous fortune when a time of trouble comes. Enormous surplus funds are being accumulated, new mills are being constructed and filled with the best and costliest machinery, new docks are being dredged, wharves and warehouses built upon their banks, railroads are being constructed, shafts enlarged, mammoth hoisting plants and air compressors installed, houses erected for employees and money is flowing like water into scores of channels.

*Read before the Congress of Mining and Metallurgy, at Paris, June, 1900.

NINE-CENT COPPER COMING AGAIN.

Perhaps some of this cash is wasted, but the greater part is being wisely expended, where it will remain in safety and return good interest. All these expenditures mean greater efficiency in mining and milling—a large scale of operations, greater production per man, smaller losses in the tailings, with mining, transportation and milling charges reduced to the minimum. When the time comes, as come it must, sooner or later, when the metal again sells at nine cents or lower, the good mines now spending money so freely will be in a position to rest on their arms and earn excellent profits at almost any selling price for copper. The expensive construction work now under way can be reduced to a minimum and in many cases done away with entirely. A cent or two, or even three, can be cut from the cost of making copper, without seriously reducing wages. In addition to the saving thus made possible, the cash surplus funds will act as a balance wheel and will enable regular payment of dividends regardless of sudden fluctuations in the metal market.

The theory and practice of mining are nowhere in a more advanced state than in the Lake Superior copper district. Nowhere upon the globe are the mines so deep or so well equipped with machinery of the largest size, though the Transvaal mines of South Africa are a close second in these particulars. The largest mines of the Lake Superior copper district have taken another great step in advance by their methods of finance, and to a large extent have eliminated the element of chance from the fiscal conduct of their properties. The copper-bearing lodes of amygdaloid and conglomerate found in this district are of altogether exceptional permanence and uniformity.

Unlike the gold, silver and copper mines of other districts, operated on fissure and contact veins, the cupiferous lodes of the Keweenaw peninsula are apparently bottomless, though as a matter of fact the copper-bearing formation extends under the bed of Lake Superior, the reverse fold of the cylindrical outcroppings on Isle Royal, forty miles to the northward of the shafts on the mainland. This eliminates very largely the element of hazard as to the continuance of the mineral reserves which are the future life of any mine, and the conservative managements of several of the best properties have pursued a fixed policy of betterments in prosperous times, and steadily increasing surplus funds, which have finally placed their shares with the best managed railroads or manufactures. Mining is usually regarded as a hazardous occupation for workmen, and an extra hazardous investment for capital, but, thanks to a happy combination of practically inexhaustible ore bodies and far-sighted financing, the best of the Lake Superior copper mines have advanced into a new class of preferred investments.

Coinage for October.

Coinage executed at the mints of the United States during October, 1900, was as follows:

Denominations.	Pieces.	Value.
Double eagles	256,000	\$5,120,000
Silver dollars	3,002,000	3,002,000
Half dollars	1,328,000	663,000
Quarter dollars	1,620,000	405,000
Dimes	780,000	78,000
Total, silver	6,728,000	4,148,000
Five-cent nickels	3,880,000	184,000
One-cent bronze	5,661,000	56,610
Total minor	9,341,000	240,610
Total coinage	16,325,000	9,508,610

A Mining Survey.

By J. F. Wilkinson, San Francisco, Cal.

A high degree of accuracy is often required in mine-surveying, in order that expensive mining work may not be misdirected. The making of underground connections by drifts or shafts located as the result of surveys presents a crucial test of correctness not usually involved in any other class of surveying. In view of these considerations, the present notes and description of a survey made in June, 1890, for the San Francisco shaft of the New Almaden quicksilver mines, may be of interest to members of the Institute who are surveyors.

The purpose of this survey was to locate on the surface a vertical 2-compartment shaft (3.5 by seven feet), to connect with another vertical shaft, of practically the same size, which had been sunk a number of years before from an adit-level about 240 feet vertically below the surface, to a deeper, so-called 600-ft. level. It will be seen, of course, that the most important matter was to secure and exact coincidence in vertical line, so that the resulting continuous vertical shaft from the surface should have no offset or irregularity at the point of junction between its two parts. The levels were of less importance; but, as the hoisting-works were to be placed in position and the new shaft permanently timbered from the start, its correct alignment was an essential requirement. The important features of the work, therefore, were the methods used in determining with certainty: 1. That the shaft was located in the right place in a general way; 2. That the ordinary inaccuracies of linear and angular measurements were so reduced as to insure correctness of location within certain defined and allowable limits.

Instruments.—The instruments used were: a Buff and Berger transit-theodolite, with a six-in. horizontal plate, reading to ten seconds; a Heller & Brightly Y-level; a Chesterman steel tape, graduated in tenths and hundredths of a foot; and New York leveling-rods, graduated to thousandths of a foot.

The leveling-rods and tape were compared with a standard of measurement, and the correction for each was ascertained. In the case of the tape, the conditions for the standard were, that the pull should be sixteen pounds; that the tape should lie horizontally on the ground; and that the temperature should be 70° Fahr. (this being the average temperature in the adit underground). Three corrections were thus actually necessary for each tape-measurement, viz.: to reduce to the standard; to correct for the catenary curve; and to correct for difference in temperature.

While the graduations on the tape were made to hundredths, yet, in careful measurements, it was possible to estimate thousandths of a foot, thus making these readings correspond in minuteness with those obtainable on the leveling rods.

Of course, to do this underground, it was necessary to use very fine fish-cord for plumb-lines; and, on the surface, measurements were made between small headless wire nails in stakes previously aligned by means of the transit. Here the hypotenuse was thus obtained, while the vertical component was obtained by leveling; and from these the horizontal component was calculated in the usual manner. Underground measurements were made on a practically horizontal plane, by means of marks on plumb-lines previously aligned by the transit, and leveled.

To correct for the catenary curve, the weight of the tape per foot was ascertained, and the correction was calculated by the usual formula. For a tape weighing 0.00725 pound per foot, with a pull of sixteen pounds (exerted in all mea-

surements by means of spring balances), the correction to be applied in 100 feet is 0.00355 foot, and in fifty feet only .00107 foot.

For temperature, the correction in 100 feet for a difference of 1° F. is 0.00069 foot. Most of the measurements in the adit were made at a temperature not varying appreciably from the assumed standard. On the surface, however, the temperature in some instances varied from the standard as much as 20° F.

In making the angular measurements, the greatest care was taken; and, by the most approved methods—repeating angles, reversing the telescope, reading both from right to left and from left to right, etc.—all possible instrumental errors, unavoidable errors of adjustment, and personal errors of observation, were eliminated. All angles were read at least twice; and in some cases as many as four readings of ten repetitions each were taken. By the means thus employed, the angular measurements were made certainly correct within one second.

PRELIMINARY SURVEY.

In the preliminary survey, the mean of two sets of tape-measurements was taken. For the surface-line, besides the tape-measurements, two sets of levels were also run. As to the surface-line it may be observed that neither monument was visible from the other; so that, in order to define the line, several settings of the transit at intermediate points were necessary.

The shaft was located by this survey, the notes having been carefully calculated and checked, use being made of Brunn's tables of logarithms, also of the natural functions from tables by a different author, thus eliminating any possible error due to misprints or other causes.

CHECK-SURVEY.

As a further precaution, to satisfy the first condition imposed, and guard against the overlooking of any glaring error in the work, a second complete survey was made, a week or more after the first. This, while made as a separate independent survey, also served to eliminate any errors of the first survey which might have been due to faulty setting-up of the transit, inaccurate centering over the stations, or sighting at the wrong station. The angles being taken differently (all being interior angles, from which the deflection angle was obtained by subtracting from 180°), any such error would have become apparent. In determining the surface-line only one set of levels was run; but an entirely different set of intermediate stakes was used, thus eliminating the possibility of repeating an error in this part of the work.

In making the calculations, the additional precaution was taken, in the check-survey, of assuming one course as a meridian line and co-ordinating the different stations with reference to a monument by courses thus obtained.

All results, however, indicated a certainty that the shaft was correctly located for all practical requirements, and to the strong probability that the corners of the shaft, as located on the surface, did not differ in coincidence from the corresponding corners on the adit-shaft by more than three-quarters of an inch.

When the connection was made, no horizontal displacement in vertical alignment was detectable; but, to test the accuracy of the survey more closely, a fine steel wire, to which was attached an eighteen-pound plumb-bob, was suspended from the collar of the shaft to the adit below. A point was selected at approximately the position of the originally located corner. This was possible without fear of the wire touching the sides of the shaft, for the reason that the shaft had been made several inches wider and longer than the collar-set of the adit-shaft. To prevent oscillation, the plumb-bob was immersed

in a mixture of molasses and water. Then, having ascertained that the wire hung freely without touching the sides of the shaft, or any other object, at any point, its position was instrumentally observed at both the surface and the adit-level. The difference between the two sets of co-ordinations is the error of the survey, and is shown in both the preliminary and the check-survey.

THE FAVORABLE CONDITIONS

It must be said that the conditions under which the survey was made were most favorable for the surveyor. The two assistants employed were reliable and experienced in that class of work; and, as no mining was being done in that part of the mine at that time, there was neither tramping, blasting, powder-smoke nor changeable draughts to interfere with observations or distract attention. On the surface, the atmosphere was clear and the air steady; and, during the first part of the survey, there was very little wind. A sufficient length of time was allowed; so that nothing was slighted or overlooked on account of undue haste.

In summary review, the special features to be noted are: (1) the means taken to insure the location of the shaft in the right place (two independent surveys and check-calculations); (2) the methods used to reduce the ordinary inaccuracies of survey within allowable limits; and also the practical demonstration, here given, of the accurate results attainable by the use of the usual surveying instruments and measuring apparatus, as described, when the most approved methods of observation are carried to the extreme, and neither time nor care is spared to make the results as nearly perfect as possible.

By the location-survey the shaft was 0.007 foot too far south, and 0.007 foot too far east; by the check-survey, it was absolutely correct north and south, and 0.047 foot too far east.

By averaging the two surveys, giving to the location-survey twice the importance or "weight" of the check-survey (because all of its measurements were made twice, while in the check-survey some were made only once), we have the average error of the survey; the shaft thus being 0.0047—foot too far south, and 0.0203 + foot too far east.*

Coal Supply in Alaska.

Broad Veins Running Down to the Sea—Hundreds of Tons Broken Off by Waves Upon the Shore—Claims Staked Out—The Nome Demand—Eskimos as Users of Pick and Shovel.

Alaska's reputation as a mining region has been given it by its wonderful gold deposits. Attention is now being attracted to its coal veins, which are found to be of great value, and the New York Evening Post has added appreciably to the hitherto small fund of general information on the subject by printing an interesting letter written by Winthrop Packard aboard the steamer Corwin, on which he had made a summer cruise in Alaskan waters. Mr. Packard writes with particular enthusiasm of Cape Lisburn, where he says limestone for the kilns of all the world, iron ore in quantities, and coal enough for the burning of the lime and the smelting of the iron can be found.

The cape itself is one mountainous mass of this limestone, white almost as marble, rising 800 feet from the sea. Behind this and running forty or fifty miles to the southward rises hill after hill, culminating in a great dome-shaped mountain several thousand feet high. Every one of these hills is clad from dome to foundation with broken limestone rubble from the weather-beaten ledges. No inch of soil, no patch of verdure finds footing on these domes or sides, nothing but the white

fragments of enduring rock. Yet in the gulches between where run torrents from the still unmelted snow banks are narrow strips of meadow, rich with blue grass and studded with countless thousands of beautiful flowers. You may not walk without crushing them under foot, and among them Mr. Packard noted three varieties of small butterflies as well as a yellow bumblebee, who hustled from bloom to bloom as cheerily as if he were among the limestone hills of Kentucky, and knew there would be no frost until November.

WHERE THE IRON IS FOUND.

Among the foothills of this white range you will find the iron ore, Limonite, and some hematite, in nodules large and small, and probably in veins. Mr. Packard found here, too, the beginning of the coal, in rather small veins, but of good quality. This, as well as all the other coal which we were to find later, is semi-bituminous, somewhat resembling cannel coal, burning with little smoke, kindling readily, and leaving a fine, white ash. It gives much heat, and was used ever since in the Corwin's fireroom, where it gave complete satisfaction, and was declared by the chief engineer to be equal to any of the Pacific Coast coal. It outcrops on the beach, and you may see the black veins making diagonals in the cliffs as you sail by.

The crow-bill ducks breed on the Lisburn cliffs in countless thousands, and their forms pepper the air and sea for miles around. They and the other sea-fowl which swarm here seem to feed largely on the annelids, a flat, brown worm as long as one's finger, and a little red jelly-like pollywog, which is the connecting link between vertebrate and invertebrate life. The sea here is at times alive with these "bugs" (as the whaling captains call them), and you cannot dip up a bucketful of sea water without finding them in it.

At times, too, it is gray with small jelly fish, on which, as well as the aforementioned creatures, the whales which frequent these waters feed. As you pass eastward from Lisburn the limestone disappears, and is replaced by sandstone and conglomerate, in which the coal appears again and in larger veins. There are bluffs in the vicinity of Cape Sabine where the veins follow one another a hundred feet apart, or less, striping the perpendicular face of the cliff with black and marking the hilltop with ridges where they run inland, at an acute angle with the coast line. The hills, indeed, are full of coal, and the ground squirrels, which are plentiful here, dig it from the ground where they burrow and mark their homes with black mounds. You may trace the outcroppings of coal by these alone for miles. This squirrel is very like the gray squirrel of the States, except that he is bobtailed. The dip of all strata here is inland and westerly, and all outcropping of coal ceases a half mile or so back from the beach. Mr. Packard prospected inland for a distance of twelve miles, just back of the finest beach property, and found nothing but sandstone. Very likely it is there, but the changed direction of the stratification prevents it from appearing.

Whether it is there inland or not there is coal enough in sight in the cliffs about Cape Sabine to supply northern Alaska for a thousand years. In places it overhangs the sea, and, with the wear-ing of the summer waves and winter ice-floes, it is undermined and falls to the surf. Hundreds of tons of good lump coal may be had on the beach there now for merely the trouble of picking it up. With much labor and rigging of tackle we hoisted one of these lumps, weighing a ton and a half, from the surf to the ship's hold, and it will be taken south for exhibition purposes. Other and larger chunks we were obliged to break up. This location is known on the charts as the Corwin coal mine; the Corwin, when in the Government

service, discovered it to be coal-bearing along in the '80s, and obtained coal from one vein here, but the place was then entirely out of the world, and little notice was taken of the fact. Indeed, the extent and value of the coal were not at all understood. About the same time the Thetis, also a Government vessel, located a vein some ten miles to the eastward and obtained coal from it. This location is marked on the charts as the Thetis mine, and we found there a weather-beaten pick and shovel, which had evidently been used in getting the coal.

A REMARKABLE VEIN.

Not far from this point is one of the most remarkable veins in the whole section. It runs in from the sea, and is noticeable in the shallow water as a black ridge sixty feet wide, from which you can break lumps of coal with a pick or bar. The strata here is pretty nearly perpendicular, so this represents the approximate real width of the vein, which runs under the beach sand into the tundra and extends inland. A little work with a shovel lays this vein bare on the beach, and you may there quarry as much coal as you please with as little labor almost as would be needed to get it from a coal-bin. Further east than this there is little coal, although the natives say there are mountains of it inland in the Franklin range. This coal deposit was carefully prospected and the bulk of it located by different members of the party, fourteen quarter-sections in all being taken up. For this land the holders will be obliged to pay the Government \$10 an acre. It is well worth it, however, for the chances are that Nome and similar Northern camps will in the future draw largely from this region for its supply of coal, which sold at Nome last spring for \$60 a ton.

The Corwin took on a hundred tons of this coal for the trip back, assisted by eight or ten families of Eskimos, who came along the coast in their walrus-hide umiaks, bound on a hunting trip up the Pitmegea River. They handled pick and shovel intelligently, and worked well and with good nature. The coal measures of the far North may solve the problem of an easier and more civilized life for the Eskimo. He needs help in some way, for game is leaving him, and he is losing the arts and means of livelihood of his fathers.

The Masters of the Iron and Coal Market.

Why Americans are Bound to Be Supreme—New Opportunities for Our Exporters—Germany Facing Disadvantages at Home—America's Advantages Here and Abroad.

By Frank H. Mason, Consul-General at Berlin.

The recent drop in the price of American iron and steel has produced a general feeling of apprehension among the iron masters and holders of industrial securities in Germany and Great Britain.

Thoughtful and well-informed men in both countries, noting the gigantic strides with which the mining and handling of ores and coal and the production of coke, pig iron, and steel were being developed in the United States, have clearly foreseen the day when, the stress of an abnormally active home demand having been satisfied, the European iron markets would have to meet the attack of an American surplus, manufactured under every advantage of cheap, abundant materials, low freightage, and the highest, most effective substitution of machinery for human labor—conditions which would enable the Americans, when the time came, to reduce prices without serious impairment of a large and profitable output.

Partly as a feeler to test the approach of this critical conjuncture, a German firm several months ago asked for proposals for the delivery

*Transactions Am. Inst. M. E.

of 100,000 tons of American pig iron. At that time the home demand in the United States was still active, and the American iron men replied briefly in the usual naive, amiable way, giving a price per ton free on board at an American seaport, but leaving the important and difficult item of ocean freight to be figured out by the European purchaser, who is naturally in no position to know whether ships for outward-bound flights are obtainable at an American port, or, if so, what rates are demanded. These early and indefinite offers created the impression here that the Americans were not yet ready or eager to sell pig iron.

But toward the end of May the announcement came that a machine foundry at Prague had closed a contract for 4,000 tons of American pig iron to be delivered at Hamburg for 73s. (\$17.01) per ton between the date of contract and the autumn close of navigation on the Elbe. When this was followed, a few days later, by a similar report than an American firm had offered to a foundry in the Lower Rhine Province a large shipment of iron for 84 marks (\$20) per ton c. i. f. Amsterdam, it was recognized by German furnace men that the hour of danger had come.

AMERICA VS. GERMANY AT AMSTERDAM

Not that the figures proposed were absolutely fatal. Eighty-four marks per ton at Amsterdam would mean, with freight to Westphalia added, somewhere about 99 marks (\$23.16) per ton delivered at the foundry, and this would be a price with which German pig iron could still fairly well compete; and thereupon the commercial press hastened to stiffen up the declining stock market by comforting reassurances that the expected American invasion had not yet begun. These, however, have not served to blind intelligent men to the fact that this offer meant nothing more nor less than that America is already in a position, notwithstanding the present high rates of freight, to deliver iron at Amsterdam somewhat cheaper than German furnace men charge to customers at their very doors. If, with a freight of \$4 to \$4.50 per ton, American iron can be landed at a Belgian, Dutch, or German seaport for \$20 per ton, what will be the situation when Southern iron—coming as undercargo in cotton ships from Norfolk, Mobile, or New Orleans, or brought in the great low-powered colliers that will yet be built—shall be carried from shore to shore at a rate of \$2 per ton or less? With all the urgent home demand of last year, Germany exported 182,090 tons of pig iron, of which 101,433 tons, or more than half, went to Belgium. Under present conditions, that item of export is already as good as lost. Every intelligent expert in Germany knows that the high wages paid to American labor have had the natural effect of forcing the managers of American iron and mining industries to practice the utmost economy in that costly item and this has compelled the invention and employment of highly perfected machinery, against which even the far cheaper labor of Europe can no longer compete on equal terms. When to this is added the other fundamental advantages of exhaustless deposits of ore, limestone, and coal, cheap transportation, and smelting and manufacturing plants of large capacity and modern construction, it needs only a corresponding development of ocean tonnage to place the future mastery of foreign markets securely in American hands. Says the London Statist: "Over and above all, the shadow of America is towering over the market."

GERMANY'S TROUBLES IN THE COAL MARKET.

The changing conditions in the iron and steel industries have brought into renewed importance the unsatisfactory state of the coal market. With all the extraordinary efforts put forth by the German coal-mining syndicates during the past three months to increase their output and supply the urgent demands of consumers, coal is still not

only dear, but scarce and difficult to obtain; and the trade journals which profess to treat the subject exhaustively generally agree that German consumers must accept the fact that they will have to pay high prices for coal and coke for a long time to come. This was bad enough during the flush times when iron and steel were selling for prices that could easily justify and recoup the cost of expensive raw materials; but with the metal market past its zenith and a general decline in prices not only inevitable, but already begun, the stubbornness of the coal market becomes a serious element in the problem. Complaints and recriminations are heard against the coal and coke syndicates, which are accused of rapacity and of deliberately keeping the output so far below the requirements of consumption as to maintain the panic prices built up during a critical period, which is now past. So great is this feeling that a few days ago, representatives of a number of boards of trade in the Rhine Province and Westphalia met at Cologne and, after a vigorous discussion, formulated an elaborate demand upon the coal syndicates, which had not been invited to attend or take any part in the conference. These demands covered important modifications in the conditions hitherto enforced by the syndicates in their sales to dealers and large consumers, and insisted that the large export coal trade should be abandoned or seriously reduced and German coal kept at home. It was pointed out that, notwithstanding the necessities of the four months ended April 30, the exports of German coal had reached 5,203,152 tons, an increase of 690,953 tons over those of the corresponding period in 1899; whereas the usual imports from the Bohemian mining region had been seriously reduced by the strike of miners and the extortionate demands of the operators.

The force of such an argument as this could not be denied, and the syndicate managers have replied that their contracts for the coal supplies of the Roumanian railways (60,000 tons per annum) would not be renewed, and that a similar contract with the railways of Sweden, which the syndicate a year ago made a vigorous effort to secure, would be likewise given up at the end of the year. There is another five-year contract for gas coal with the city of Paris which will have to be fulfilled, but all other foreign contracts were for one year only and will not be renewed at expiration. Hitherto, the syndicates have had a rule to sell not less than 500 carloads of coal to one purchaser, and this operated to force all small consumers to buy their supplies from dealers or middlemen. At the demand of the meeting at Cologne, this minimum limit has been reduced to 250 carloads, which will permit an increased number of consumers to buy directly from the Syndicate.

THE ONE WEAK POINT.

These concessions are good so far as they go, but they can at best only serve to mitigate the difficulty, which is based upon the fundamental and stubborn fact that the consumption of coal in Germany, Russia, Austria, Italy, and France has outgrown the normal home supply of those countries; that as mines grow deeper and wages and cost of living increase, the expenses of mining and therefore the cost of producing coal has become greater; and that, in common with the iron industries, shipbuilding, and other branches of manufacture, coal operators everywhere have naturally sought the opportunity to make greater profits, and this they will continue to do as long as the demand for fuel continues. The one controlling force which consumers have in their hands is increased imports. The coal syndicates regulate practically the entire domestic supply and are too powerful and ably managed to be swayed by any argument that does not appeal to their interests. As the prices of finished products

decline, the necessity for cheaper raw materials—notably coal and pig iron—will become more urgent, and this necessity will continue to present an opportunity for American exporters. Whether a wiser, more far-sighted economy might not dictate that these materials should be worked up at home and only the ultimate finished products exported is, of course, another question which need not be considered here. Intelligent opinion in Europe concedes that when values in the iron and steel markets have settled down to a normal level, the Americans, by virtue of their power of cheap production, will remain masters of the field. It remains to be seen whether they will strengthen their one weak point—ocean tonnage under their own flag—and play the commanding role to which they are entitled.

A General Rise in Prices.

It will be surprising if the extraordinary increase in gold production certain to occur in the next few years does not result in a general advance in prices. The product of the Yukon and Alaskan fields is already directly affecting the money markets of the world. English supremacy in South Africa will sensibly reduce the cost of mining there, will make possible the development of mines hitherto unworked, and will vastly increase the general output of the region. Some time will be required for the working out of these causes, but within two or three years the world's product of gold will be greatly augmented, the cost of mining it somewhat reduced, the supply for the money markets increasingly ample, the stimulus to trade correspondingly marked; and the natural sequence will be a general rise in prices.

British Columbia's Mining Activity.

Writing from Vancouver under the date of September 18, United States Consul Dudley gives an interesting outline of a recent visit to the eastern portion of British Columbia and its mining sections. The Le Roi mine, he says, ships three train loads of ore each day to its smelter at Northport, Wash.; a body of much richer ore has been recently discovered, and engineers report that \$10,000,000 worth is in sight. The smelter at Northport has recently doubled its capacity and works twenty-four hours every day, and is still unable to handle the output; the same may be said of the smelter at Trail, which handles the ore of lower grade. Mr. Dudley continues:

A branch of the Canadian Pacific from Robson to Midway, about 100 miles long, has just been opened, and a new smelter has been erected at Grand Forks. At Moyie City, near the Crows Nest Pass (on a new line of the Canadian Pacific), which has been opened less than two years), I found a very large concentrating plant, and it is claimed that the shipments from the lead and silver mines at Moyie are larger than from any other single mine on the continent.

At Fernie are extensive mines of the best possible quality of bituminous coal, which now turn out 1,100 tons each day. Three hundred and twelve coke ovens were at work and 110 more in process of construction. About 380 tons are being shipped per day, and the manager says the output will be doubled in the next three months. A train load of coal is shipped west and south from Fernie each day to supply the Great Northern Railway, and another train load of coke is sent east and south daily.

From the Slocan district, ores containing a very large percentage of lead or "wet ores," as they are called, are shipped to different smelters in British Columbia and the United States, and even as far as Chile, to be used in fluxing the dry ores found in those districts.

Latest Mining Decisions.

Specially Prepared for THE MINING AND METALLURGICAL JOURNAL.

Complainant and defendants were joint owners of a group of mining claims, and defendants were owners of an adjoining claim. A tunnel had been run through the group owned jointly, for the purpose of working that property; and defendants extended the tunnel into the property owned by them, and the use of the tunnel by defendants in working their property resulted in the exclusion of the complainant from the tunnel. Held that the complainant was entitled to an injunction restraining defendants from excluding her from the tunnel. People ex rel. Greene et al. vs. District Court of Lake County et al., 62 Pac. Rep. (Colo.) 206.

Plaintiffs executed a bond and lease of a mining claim to defendant, who was also a part owner, under which defendant went into exclusive possession. He subsequently took proceedings to forfeit the interests of plaintiffs for refusing to pay their share towards assessment work, which they claimed he had undertaken by the bond and lease to do at his sole expense. After such proceedings for forfeiture, defendant applied for a patent, and obtained a receiver's final receipt in his own name. Held, that the rights of plaintiffs in the claim were not matters which could be adjudicated by the land department of the United States, but were within the jurisdiction of a court of equity, and that plaintiffs were entitled to maintain a suit for their determination without waiting until a patent for the claim had been issued to defendant. Malaby vs. Rice et al., 62 Pac. Rep. (Colo.) 228.

TRADE NEWS.

The M. C. Bullock Mfg. Co. of Chicago has issued an attractive announcement of its success at the Paris Exposition in receiving a gold medal for its diamond drills. The Bullock drill was the only diamond drill to receive an award at the exposition. The Bullock drills received three medals at the Chicago Fair in 1893 and they have always received awards wherever exhibited.

The Joseph Dixon Crucible Co. of Jersey City, N. J., is introducing a new sight-feeding graphite lubricator. The lubricator can be used on all kinds of engines, single, compound or triple expansion. The lubricator was patented on September 4, 1900, by Fred Gielow of Chicago.

PERSONAL.

W. H. Wells, manager of the California plant of the American Tin Plate Co., is in the east on business connected with the company's affairs.

Low E. Aubrey, M. E., has returned from the northern part of California to his home in Los Angeles. He will probably go north again soon.

Eugene B. Braden is now general manager of the East Helena smelter, having succeeded Charles W. Whittey who is now at Salt Lake City.

W. Lewis Bell, of the Fulton Engine Works of Los Angeles, has been in Randsburg for the purpose of figuring on the new mill of the Yellow Aster Mining and Milling Co.

Paul Staritz of Moscow, Russia, is in the United States as the representative of a Russian technical society. His purpose is to study American methods of workshop construction.

E. H. Stagg is now general manager of the Barstow Reduction Works at Barstow, San Bernardino county, Cal. It is proposed to keep this fine custom plant running full time from now on.

Frank Davis, formerly metallurgist of the Rawhide mine at Sonora, Tuolumne county, Cal., is now superintendent of the property in Sonoro, Mex., owned by the Sonora & Chicago Mining Co.

E. Sprague, well known for many years in publishing circles in Chicago, died on October 3 at his home No. 2738 N. Hermitage Ave. For several years he was the Chicago representative of this paper and he has many acquaintances in Chicago among firms well known in the mining industry. He organized and was president of the National Trades Press Association, and was also at one time president of the St. Louis Trades Press Association. For a number of years he was publisher and proprietor of the St. Louis Grocer and General Merchant, and also of the St. Louis National Druggist.

Construction and Development News.

The Shawmut's chlorination plant will be ready for operation shortly.

The Birdena mine at Campo Seco, Calaveras county, Cal., is to have a new hoist.

Ten stamps are to be put upon the Hope property at Sonora, Tuolumne county, Cal.

At Carson, Calaveras county, Cal., the California-Ophir Co. will soon be erecting a mill.

Coal mines near Dunlap, Tenn., will soon be developed by the Douglas Coal Co. of that place.

A hoist and mill will be placed upon the De-fender mine, near Volcano, Amador county, Cal.

New machinery is being installed at the Mt. Pleasant mine, near Grizzly Flat, El Dorado county, Cal.

The Golden West Mining Co. may need a new mill shortly for its property at Sonora, Tuolumne county, Cal.

The Twin Sisters Gold Mining Co. of Centerville, Ida., E. J. Blain superintendent, will erect a five-stamp mill.

Power drills and a compressor are to be installed at the Castle Peak mines, near Bridgeport, Mono county, Cal.

A set of water wheels will be needed at the Sheep Ranch Gold Mining Co.'s property at Sheep Ranch, Calaveras county, Cal.

The Dewey mine, near Gazelle, Siskiyou county, will soon erect a ten-stamp mill to handle the ore now being shipped to Keswick.

Chas. B. Holladay, of Richmond, Va., has with others organized the Spotsylvania Mining Co., which will develop pyrites mines.

The Southern Car & Foundry Co. is repairing and overhauling its rolling mill at Anniston, Ala., and will soon resume operations.

The Cherokee hydraulic mine at Cherokee, Butte county, Cal., will have an entirely new equipment. L. J. Hobie is the manager.

Additions are being made to the concentrating plant of the Cambrian mine at Granite Hill, above Placerville, El Dorado county, Cal.

Fred Zeidler is manager of the Champion Mining Co.'s property at Nevada City, Cal., where a hoist and pumping plant are to be installed.

The thirty-ton cyanide plant of the Goleta Consolidated Mining Co. is nearly ready to commence operations at Jordan, Mono county, Cal.

The Eocene Mining Co. at Camanche, Calaveras county, Cal., is putting in machinery. J. B. Truman of Wallace, Calaveras county, is the superintendent.

A chlorination plant is to be erected at the St. Gotthard mine near North Columbia, Cal. B. M. Shoeraft, 113 Crocker Bldg., San Francisco, is the secretary.

Capt. J. R. De La Mar intends to install a 500-ton cyanide tailing plant at his De La Mar, Nevada, property. F. P. Swindler is the general superintendent.

E. McCormick, whose address is Siegelton, via Luning, Nev., will superintend the erection of a 100-ton furnace for the Vulcan Copper Mining & Smelting Co.

A 100-ton concentrator will be erected upon the North American mine near Baker City, Oregon. Thos. Burke, of Des Moines, Iowa, is president and manager.

J. C. Heald, owner of the Montezuma Mine at Nashville, El Dorado county, Cal., will install power drills and a compressor. J. F. Blewett is the superintendent.

The Middlemarch Copper Co., under the management of M. M. O'Gorman of Los Angeles, Cal., is about to increase the capacity of the machinery at its mines at Middlemarch, Ariz.

A cyanide plant and chlorination outfit is to be erected on the property of the Clinton Consolidated Gold Mining Co. at Jackson, Amador county, Cal. David Fisher is manager.

A 120-stamp mill will be erected at the North Star gravel mine, Mokelumne Hill, Calaveras county, Cal. P. L. Shuman, Call building, San Francisco, is the general manager.

It is reported that 100 more stamps will be erected at the Golden Cross property at Hedges, San Diego county, Cal., and the 240-ton cyanide plant increased to a 1,000-ton plant.

The Keystone Consolidated Mining Co., W. A. Pritchard superintendent, at Amador City, Amador county, Cal., will soon have a cyanide and chlorination plant upon its property.

A 100-ton concentrator is to be built upon the property of the North American Mining Co. at Baker City, Ore. Thomas Burke of Des Moines, Iowa, is the president of the company.

W. W. Robbins is manager of the Concord Gold Mining Co., whose property at Lawton, Oregon, is to have the tunnel run in to 1,500 feet and the erection of a mill and other machinery.

The Dayton Mining & Milling Co. of Dayton, O., of which J. E. Parker is superintendent and general manager, has purchased the Henderson mine, in Missouri, and expects to equip it with new machinery.

The Ritter-Conley Mfg. Co. of Pittsburg, Pa., will erect three new furnaces for the American Steel & Wire Co. at its plant on Neville Island. The Bessemer converting mill will be started about the same time.

Capt. T. F. Singiser, who has been at Knutsford, Utah, has gone to Salmon City, Ida., and will probably give orders for the starting up of the mill on the property of the Salmon River Gold Mining Co.

E. T. Roy of Kingman, Ariz., has been in Philadelphia, Pa., trying to arrange the sale of the Barry group of mines at Chloride, Ariz. It is likely that an improved concentrator will be erected at once.

O. L. Shuman, Call building, San Francisco, Cal., is general manager of the North Star Gravel Mine Co. at Mokelumne Hill, Calaveras county, Cal., upon whose property a twenty-stamp mill is about to be erected.

The Cornucopia mines of Oregon, owned by John E. Seares, of New York, but managed by Allene Case, of Cornucopia, Oregon, is to have twenty stamps added to the present mill, and a cyanide plant to treat tailings.

Dr. Hendrix is the owner of the Empire mine, on Groom creek, seven miles from Prescott, Ariz. He will increase the plant as fast as the mine requires. It is rumored that the battery will shortly be increased to thirty stamps.

The App Consolidated Gold Mining Co., W. H. Martin, vice-president and general manager, Crocker Bldg., San Francisco, is installing a forty-stamp mill at the Rawhide and App mines at Jamestown, Tuolumne county, Cal.

The Wardner, Idaho, properties of the Empire State-Idaho Mining & Development Co., under the management of W. Clayton Miller, are to be thoroughly developed, a new mill erected and eighteen miles of flume constructed.

Considerable work is being done at the Keystone, Amador City, Cal. W. A. Prichard is superintendent. He says they are sinking a new shaft, increasing the capacity of the present mill, and will erect a cyanide and a chlorination plant.

The McClintic & Marshall Construction Co. of Philadelphia, Pa., has purchased fourteen acres of land at Moneessen on the Monongahela river. The purpose is to erect structural iron works which will have a monthly capacity of 7,000 tons of finished material.

Allene Case is manager of the Cornucopia mines of Oregon, owned by John E. Seares of New York. The property is situated near Cornucopia, Ore., and twenty more stamps are to be added to the present mill, with a cyanide plant to treat the tailings.

A new hoist and concentrating mill are to be erected on the Silver King mine at Ketchum, Ida., under the management of Knox Taylor. The properties of the Hepburn Gold Mining Co. at Jackson, Amador county, Cal., will be equipped with a ten-stamp mill.

The addition of seventy stamps to the thirty-stamp mill of the Yellow Aster Mining & Milling Co.'s property at Randsburg, Kern county, Cal., is the latest move contemplated by that excellent company. John Singleton of Los Angeles, Cal., is the general manager.

Capt. J. D. Burgess of the Panama mine in Old Hat district, Kingman, Ariz., has sunk a double compartment shaft. He has a force at work, not only developing the different properties, but clearing and grading grounds for a large concentrating plant shortly to be erected.

The Tesia coal mines, in Alameda county, Cal., owned by the San Francisco & San Joaquin Valley Coal Co., are to have a coal briquette plant and a Portland cement plant in connection with the mine. B. M. Bradford, 328 Montgomery St., San Francisco, Cal., is the secretary.

The Black Jack Mining Co. is a new corporation at Nogales, Ariz., organized for the purpose of

prospecting and developing mining properties in the Patagonia and Santa Rita mountains. The incorporators are R. R. Richardson, A. E. Crepin, Richard Eams, Jr., and W. H. Barnett.

The Palmetto Gold Mining Co. has been organized at West Springs, S. C., to operate the West Springs gold mines. The company will establish a plant and equip it with automatic machinery for handling the quartz. L. C. Cannon of Spartanburg, S. C., is one of the incorporators.

The National Gear Wheel & Foundry Co. at Allegheny, Pa., has purchased ground adjoining its plant, and will erect an iron-clad building for the manufacture of gas engines. The building will be equipped with new machinery, a portion of which has been bought. A crane will also be installed, but the size has not as yet been determined.

F. Feekel, a civil engineer of Pittsburgh, Pa., has completed plans for an extension to the plant of the Frank-Kneeland Machine Co. of that city. A specially arranged pattern storage warehouse seventy-eight by one hundred and fifty feet, and an addition to the foundry will be erected early next spring, the buildings to be of steel frame construction.

At the Melones Cons. Mining Co.'s property near Robinson's Ferry, Calaveras county, Cal., W. C. Ralston is superintending the construction of a dam in the Stanislaus River to turn water power, and a flume which will cost about \$72,000. A 120-stamp mill is in course of erection and thirty-six Froue and twenty-four Wilfley concentrators are to be used.

Extensive improvements are under way by the Oregon Ore Reduction Works, which owns seventeen copper properties in Burklemon, Ore. The concern will erect wooden hoisting works equipped with air-compressing machinery and electric light plants. The company will require about twenty boilers, seventeen hoisting engines, a number of water-wheels, engines, pumps, motors, and a stamp battery.

The Tanana mining district of Alaska still occupies the attention of prospectors. There is a large area with more streams than in any other mining district so far discovered in Alaska; all bear gold, which will give work later on to an army of miners. The cost of transportation to this region is now too high—\$1.25 per pound. This, added to the cost of provisions, etc., makes it very expensive to work there. Many miners staked claims and may possibly never return. The mining laws of the United States do not require representation of claims for one year after the 1st of January after recording. This gives owners until 1902 to prospect, practically locking up the country.

CORRESPONDENCE

CALIFORNIA.

(From Our Special Correspondent.)

Isabella, October 1, 1900.

A recent canvass of the output of the Kern river gold mines shows that the gross yield for the last three years has been \$412,000. This would be an average of \$137,333 a year. The outlook for the coming year would seem to favor a much increased output.

There are three gangs of miners at work at heavy development work, on Bodfish creek, south of this place, on three large separate veins, and it will be a disappointment if the Bodfish mines do not produce \$100,000 within the next year.

Major H. M. Russell of Los Angeles, manager of the Mammoth mine at Keysville, southwest of this place, is preparing to quadruple the capacity of his ten-stamp mill, and provide a tramway and an electric plant for his mine. This mine, in addition to an immense outcrop of low-grade rock, has yielded thousands of tons of forty-dollar rock, and still the center of the hill is solid ground, and very little of the mine has been worked 100 feet deep, notwithstanding that all recent developments in these old mines point to a quarter depth for the best pay.

The Old Keys mine, after thirty-eight years of idleness, is coming to the front as a gold-producer, and the Walker Bros., who own the mine, believe they now have more ore before them than has ever been taken out of this noted bonanza.

E. L. Allison, a prospector and assayer, recently struck, on Kern river, in Tulare county, fourteen miles north of this place, a prospect which may prove of great importance. The rock is from a large formation and carries free gold, indicating twenty to forty dollars a ton. This would seem to indicate the extension of the Big Blue lode eight or ten miles further north than it has ever been traced before. The main state belt, extending from this Allison discovery to Plute passes east of this place, and has generally been looked upon as offering only a prospect for base metals, but this discovery will raise the question as to whether depth may not ultimately expose other deposits of gold. Prospectors in Silverado mountain have generally thought it useless to assay for anything except silver, while their old dumps carry a greater value in gold, in many cases.

The old St. Johns mine at the head of Keiso canyon is being reopened and promises to become once more a gold producer.

There is a report of an important discovery of copper ore northwest of Walker's pass, but I have seen no one who could verify the report.

STEPHEN BARTON.

WASHINGTON.

(From Our Special Correspondent.)

Seattle, Wash., November 5, 1900.

The Government Assay Office at Seattle received in the twelve months ending October 24, 1,243,163.36 ounces of gold valued at \$20,186,687.54. The deposits were made by 6,028 persons, and came from various mining districts as follows: Cape Nome, \$2,710,427.01; Klondike, \$16,374,488.16; other Alaska districts, \$162,893.31; Atlin, \$493,116.27; Washington, \$125,762.80. Since these figures were prepared 900,000 more has come into the assay office, one-third of which was from Nome and the other two-thirds from the Klondike. The total output of the Nome mines will be nearly \$5,000,000 for the year. Much gold dust is now tied up at Nome pending decisions on several big law suits over mining claims.

Seattle has heard of an immense copper discovery by Minneapolis miners in the Copper River district, 190 miles from Valdez. The discovery was made after three years of prospecting. The owners say they have found a great ledge from which the Indians once drew their supplies for arrow heads, bullets and ornaments.

The owners of the Copper Belle mine in the Index district, Snohomish county, say that they are eminently satisfied with their experiment with their ten-ton pyritic smelter. They have ordered a larger and more expensive plant.

MEXICO.

(From Our Special Correspondent.)

Magdalena, Sonora, Mexico.

October 29, 1900.

The mining development of the state of Sonora is constantly on the increase. New men and capital are coming and vast quantities of machinery and supplies are seen going to remote quarters.

The men at the head of these enterprises are mostly Americans, with quite a sprinkling of English, French and Germans. They all speak well of the prospects and consider the laws very favorable for the development of the mines by foreigners. Immense deposits of copper are found near the dividing line of the United States and Mexico, while good paying gold and silver mines that have been worked for years are still being worked with increased capacity and force.

The northwestern and western sections of the state are attracting the most attention. From every station from Nogales to Ortiz, on the Sonora Railway, mining men are starting out east and west in quest of new territory, and to help develop established plants.

Hermosillo, Torreón and Magdalena seem to be the mining centers on the line of the railway. Most of the mining men are anxious to have a smelter located at one of the towns on the railway in the northern part of the state. They believe it would pay and be the means of further developing the mining properties hereabouts. At present the cost of shipping ore to El Paso, Texas, eats up one-third the value of the ore, which is a strong argument in favor of a smelter.

The Yaqui war, which is still on, has given a back-set to the successful working of many mines, but much more could be said relative to many mines in the state that are not easy of access by

railway. The matchless climate of Sonora from November to April is very favorable to the miners in general.

I will close by giving a few items about the district of Altar, which is known to be one of the richest of the state of Sonora for its ledges of gold and silver ores, and also for placer mining. There are several good prospects of copper and antimony. Several claims have been taken lately on old abandoned mines, and with good results.

Among the most successful may be mentioned the following: Quilovaca Mining & Milling Co., La Compania Gold Mining Co., La Compania Mexicana Co., Sierra Pinto, The Bertho Mining Co., Hart & Co., El Tiro, Diego a Moreno, La Compagnie des Mines d'Or de San Pedro, Diego Oretoga, San Manuel Mine.

The American company of La Sierra Pinto, which has very rich mines, is now building a railway from San Jorge Bay to the properties.

The following are the principal placer mining camps in the Altar district of Sonora, Mexico: La Cienega, El Tiro, El Tron, San Perfecto, Las Palomas, Juarez, Quilovac and San Antonio. All these are working and taking out more or less gold dust. The improvement of the whole district is being carried on mostly by Americans.

GEO. E. PLACE.

GENERAL NEWS

ARIZONA.

J. T. Pendergrast has located another vein on the Green Linnet grounds, Union Basin, and is sinking a shaft on the ledge. In striking eight feet he took out fifteen sacks of ore running twelve ounces and forty ounces silver to the ton.

It is rumored that a body of high grade ore has been found in one of the Octave mines near Tucson. The ore body is reported to be six feet wide with ores ranging from \$19 to \$30 a ton.

Harvey & Findletter are preparing ore for shipment at their Copper Hill mine near Oak Springs. The ore is said to be of a high grade.

The Middle March Copper Co. at Middlemarch, Ariz., intends to increase the capacity of its plant by the addition of new machinery. There are from thirty to forty men employed at present, but when the furnaces are running the force is increased to sixty to 100 men. The present force is employed in developing the workings, sinking deeper and enlarging the buildings. There is a fifty-ton furnace now on the property run by steam power. The depth of the main shaft is 200 feet from adit level and 400 feet from summit. The tunnel is in 650 feet. The company owns the Missouri and twenty-two other mines, carrying copper with gold, silver and zinc.

CALIFORNIA.

It is reported that the mine sold by Young Pray to Hirshfeld & Stanley in the State range in northern San Bernardino county, near the Dean & Jones mill, has struck a rich vein of free milling ore, averaging about \$230 to the ton, having a width of three feet. The owners now intend to have a mill test made at the Red Dog mill, near Randsburg, in Kern county, of four or five tons. There were several veins encountered by the two workmen, and the outcroppings on various parts of the claim are very rich.

The Joshua Hendy Machine Works have built for T. N. Stebbins two triple-discharge three-stamp mills, which have been sent to the O-B-Joyful mine in Tuba canyon, Kern county, owned by Mr. Stebbins.

The Union Consolidated Gold Mining Co., with a capitalization of \$50,000, has been organized recently with the following officers and directors: U. S. Marshal H. Z. Osborne, president and manager; W. M. Van Dyke, U. S. Commissioner and U. S. clerk of the Circuit Court, secretary; Dr. E. C. Keller, treasurer; S. B. Osborne and Olin Wellborn, all of Los Angeles, Cal. The holdings of the company embrace 240 acres of patented land in Hickory gulch, Trinity county, and on Union creek, the recently purchased Dorleska mine, together with 320 acres of patented land adjoining the mine. Work is being prosecuted on the Dorleska.

Lew E. Aubrey is developing the Roma and Santa Rita mines on Bear creek, in Mariposa county, and reports the lower tunnel in now over 940 feet. Word recently received from there says

the vein has been encountered. A cross cut has been started from near the end of the tunnel north to cut the Roma vein. Recent developments prove this to be one of the largest fissure veins north of the mother lode—a distance of sixty-five feet intervening between walls.

Thirty tons of ore from the Sydney annex, forty tons from the Boone & Ricketts and twenty tons from the Golden Rule mines at Randsburg, Kern county, were recently treated at the Red Dog mill. The ore from Boone & Ricketts Santa Ana mine went something over \$50 to the ton.

It is stated on good authority that the smelter at De La Mar's Bully Hill mines will be in active operation by January 1. The boiler house, engine room and machine shops are completed and some of the machinery has been installed.

The work of sinking in the shaft at the Mariposa mine, one of the properties owned by the Mariposa Commercial Mining Co., was recently resumed. The outlook for the mine is very promising at present. The company is putting in a large hoist and intends to run two skips.

The Stringer district of Kern county is developing considerable activity. Charles Koch says he has \$10,000 worth of ore in sight in the Winnie mine. Work on the Sunshine mine will soon commence anew. The Gold Coin property is showing up well under the work being done, drifting and blocking out ore. A great deal of leasing is being carried on in the Stringer district.

The Golden Jubilee Mining Co. on Coffee creek, Trinity county, is putting in a boiler and machinery.

Pugh & Menzell at Clear creek, Shasta county, are sinking a double-compartment shaft, timbered throughout. A hoisting plant will be added, with a pump to keep down the water which is coming in at the fifty-foot level. Roads have been graded and the company will shortly ship a consignment of good ore to the Seiby smelter at Vallejo, Cal.

Work is progressing on the new forty-stamp mill at the App mine at Quartz, Tuolumne county.

The Iron Mountain Investment Co. has not as yet purchased the Bolaklala copper mine, as anticipated.

Operations will soon be in full blast at the Melones mine in Calaveras county.

A new compressor and a cyanide plant has been shipped from Merced to the Hite Cove mines near Mariposa in Mariposa county, Cal. E. L. Foster is the president.

R. Pritchard, superintendent of the Radamachir mine, in the district of the same name, near Randsburg, has returned to work. The mine is a good one and only awaits development.

A mill run of fifty tons of ore from the Butte mine at Randsburg gave a gold b.ick worth \$4,650.

A car load of heavy machinery for the Gold Bluff mine in Sierra county arrived at Nevada City lately, including two new air compressors.

Supplies are arriving at Nevada City for the Merrimac mine, which is located above Gennbrook Park in Nevada county. It is understood that operations will be resumed in a short time, the mine pumped out and development work commenced.

The Church mine, three miles south of El Dorado, El Dorado county, one of the best known mines in the country, which has lain idle for over two years, has been bonded to C. J. Ga. land of Oakland, Cal., and others, and is being unwatered preparatory to being reopened. The shaft is 1,000 feet deep, and there is a ten-stamp mill on the property.

Development work is being pushed forward at the Hart Consolidated mine, south of Georgetown, El Dorado county.

The Dewey mine at Squaw creek, Siskiyou county, is still supplying a car load of ore every day for shipment from Gazelle to Keweenaw, and the returns continue to be as good as ever, with a great quantity of ore in sight.

The ten-stamp mill at the Central Eureka mine, near Amador City, Amador county, is kept busy night and day crushing rock from the 1,600 and 1,700-foot levels.

At the Angier mine, near Georgetown, El Dorado county, development work is being vigorously prosecuted. The two-stamp mill is running every day on good ore taken from the shaft, which is down only twenty-five feet.

It is reported a new company will probably assume control and work the Uncle Sam mine in Tuolumne county.

Bodie, Mono county, has had three mills running for some time past. The Standard has twen-

ty stamps. The Bodie Tunnel mill has fifteen and the Syndicate ten, making a total of forty-five stamps.

At Citrus, Inyo county, the Mazurka Mining Co. is working a double force of men on its placer property in Mazurka canon. About 600 feet will complete the tunnel to bedrock, which will then have a total length of 2,400 feet.

Barnes & Anderson are still at work putting up their five-stamp mill for their mine six miles from Citrus. The mill is erected at Willow Springs, two miles from the mine.

David Fisher, manager of the Clinton Consolidated Gold Mining Co. of Jackson, Amador county, owner of the Union and Paugh mines, is about to erect a cyanide plant and replace the chlorination plant owned by this company. They have a four-ton chlorination mill, but it is not large enough. There is a thirty-stamp mill, and ten concentrators are run by water power working the ores of these mines, employing forty men to keep them supplied. The shaft is to be deepened to 1,000 feet, it being now only 500 feet deep. There is also an 800-foot tunnel on the property.

A twenty-stamp mill will be erected at the North Star Gravel mine at Mokelumne Hill, Calaveras county. P. L. Shuman is the general manager.

The Keystone Consolidated Mining Co., whose property is under the superintendence of W. A. Pritchard, is sinking a new shaft on the Keystone mine, near Amador City, Amador county. The old shaft is down about 1,200 feet. The mine is pretty well equipped, having a forty-stamp mill and sixteen concentrators at work, but it is the intention of the company to increase the capacity of the plant, and also to erect a cyanide or chlorination plant. A variety of power is used for different purposes—steam, water, electricity and gasoline being utilized to run the plant. Ninety men are employed in and about the property.

COLORADO.

The Smuggler Union Mining Co. has secured control of part of the waters passing over the Bridal Veil Falls in San Miguel county, and will henceforth run its Pandora mills by this water through the summer season. A flume is being extended to the mill from the falls. A new wire rope tramway is also being put up by the company from the mills to the Pennsylvania tunnel. Edsall, Key & Co. are now in control of the Constantine Consolidated Mining Co. in Teller county. Mr. Hobbs of the firm is acting as president and general manager.

Austin Blahey, manager of the Little Chief Mining Co. at Leadville, is conducting extensive surface improvements at the Little Chief mine.

At the mill of the Liberty Bell Gold Mining Co. in San Miguel county, one mile above Telluride, forty new stamps are being installed, thus increasing the capacity of the mill 300 tons.

The latest report from the Vindicator Consolidated Gold Mining Co. at Cripple Creek shows mine expenses of \$64,463; payment to lessees, \$34,883; equipment expenses, \$11,859; buildings, \$4,050; taxes, \$6,530; total, \$121,085. The net profit remaining after these expenditures is \$40,243.

IDAHO.

A stamp mill of ten tons a day capacity has recently arrived for the Jupiter mine on Deer Creek, six miles north of Idaho City. John E. Kinkaid is the owner.

Unusual activity is reported on the Checkmate mine, the best known mine in Pearl. The shaft is down 200 feet below the apex and is rapidly growing in width. The mine is much richer in the lower level than at any point above.

The new Jumbo mill at Halley will be ready to run on December 1. The Golden Star mill near the Jumbo will start up at about the same time.

The Twin Sisters Gold Mining Co. owns property at Centerville, which is under the superintendence of E. J. Blain. The Golden Fleece and Golden Star mines are in the group, on one of which is a 250-foot shaft. Steam power is used to run the five-stamp mill. It is expected that five more stamps will be added to the mill in the near future. Fourteen men are employed.

The Golden King group of mines near Mountain Home has a shaft 300 feet deep, and a tunnel 3,000 feet long on the property. The shaft will be deepened to the 600-foot level by January 1. The

property belongs to the Crown Point Gold Mining Co., Ltd., and has twenty-five men employed under the superintendence of Daniel Reber.

The Silver King Mining & Milling Co., with Knox Taylor in charge, will soon erect a new mill and concentrating plant at Ketchum. They have already two concentrators run by steam. Work in the 600-foot level is looking up well.

The Empire State-Idaho Mining & Development Co. is making important improvements in its property at Wardner. The tunnel is to be extended 7,000 feet further in. A new mill and eighteen miles of flume will be erected. The concentrating mill has a capacity of 400 tons in twenty-four hours, and the whole plant is operated by steam, gasoline and water. More than 200 men are employed in and about the mine under the management of W. Clayton Miller. The main tunnel is now in 6,600 feet on good ore.

The Gladiator, owned by the Alturas-Senate Mining Co., at Ketchum, is to have better ventilation. Knox Taylor, the superintendent, has ten men employed extracting the ore. Gasoline is used as power. A tunnel is in 1,500 feet on this silver-lead property.

MICHIGAN.

The new No. 7 shaft at the Quincy property has been placed in commission. The company has heretofore operated five heads of stamps. With the new mill in operation, eight heads of stamps will be crushing rock, and within a month or two the yearly production of the mine will be brought up to a basis of 20,000,000 pounds of copper per annum. The major portion of the construction work at the mine is practically completed, at least for the present. Within the past two or three years \$1,000,000 has been expended for new construction and improvements. A portion of this money was charged to operating expenses and a portion was charged to the receipts from new capital issued a few years ago. The company's cost of copper this year excluding construction charges will be in the neighborhood of eight cents per pound and the cost next year is expected to be around this figure. It is very likely that as soon as regular production begins from the No. 7 shaft, No. 6 will be temporarily closed down for repairs.

MONTANA.

Carl Weingren has bonded two manganese claims near Philipsburg on a royalty basis and is now developing them on an extensive scale. He expects to ship three carloads daily to the Chicago plant of the Federal Steel Co., with whom he has a contract for 5,000 tons. The ore comes from a belt of veins between the Hope and Granite silver mines, and is unusually high grade, running from forty to fifty per cent manganese.

C. W. Whitley, representing eastern capitalists, has made the second payment of \$5,000 on the bond of the Huffaker copper claim in West Helena. The returns from the first five tons of ore taken from this claim were most satisfactory.

NEVADA.

F. P. Swindler, general superintendent of Capt. J. R. De La Mar's Nevada gold property, says the main shaft is 1,100 feet deep, and a tunnel is 3,100 feet. Steam and electricity are used to run thirteen Griffin mills and a 300-ton per day cyanide plant. The men employed now number 225. A 500-ton per day cyanide tailings plant is contemplated.

The Vulcan Copper Mining & Smelting Co., whose property is under the charge of E. McConnick, at Siegelton, near Lansing, Esmeralda county, will erect a 100-ton furnace in the near future. Sixty men are in the employ of the company. The main shaft is now down 350 feet. The whole works in and around the property is run by gasoline engines.

The Morning Star Mine at Dean, Lander county, is owned by Walter Dean of San Francisco. Daniel J. Housfield is the superintendent. Steam power is used and an equipment of compressed air machinery is on the property, together with a ten-stamp mill. It is the intention of the management to run the main tunnel, now in 1,200 feet, to a distance of 3,000 feet, which will strike the vein below the present workings. A two-compartment vertical shaft is being sunk to connect present workings with the lower tunnel. Forty men are employed.

OREGON.

Work has been resumed on the old Sanger mine which has recently been bought by New York capitalists for \$100,000. The ten-stamp mill is crushing about forty tons of ore daily.

Promising deposits of coal have been found in several places in Eastern Oregon. Some of the coal is of excellent quality. A number of veins have been found east of Baker City.

The Mammoth Gold Mining Company has just made one of the biggest strikes on record in the Sumpter district. With a shaft down 180 feet a vein was encountered which is eighty-five feet in width and which shows values from \$1 to \$3,200 to the ton.

The North American Gold & Copper mine, owned by the North American Mining Co., near Baker City, has a shaft down 200 feet and a tunnel in 100 feet. Steam is used for hoisting purposes. There are thirty-five men employed. The outlook at this property is excellent. A 100-ton concentrator is to be built.

John E. Scarles of New York is the owner of the Cornucopia mines of Oregon at Cornucopia. It is the intention of Mr. Scarles and his mine manager, Alliene Case, to add twenty more stamps to the present twenty-stamp mill, and also a cyanide plant to treat tailings. Seventy-five to one hundred men are employed. A set of concentrators, twelve in number, take the tailings from the mill and save a good percentage of the mineral. The main development work consists of a 1,700-foot tunnel and an 800-foot shaft. Water is used to run the machinery and generate electricity for transmission purposes.

W. W. Robbins, the manager of the Concord Gold Mining Co.'s property at Lawton, says a 1,500-foot tunnel will be completed on the mines, and a new mill and other machinery installed to work the gold and silver ores. Twelve men are at work for the company.

SOUTH DAKOTA.

It is estimated that the total output of gold from the Black Hills to date has been about \$100,000,000.

There are now in operation in the Black Hills thirteen cyanide plants. Eleven of them are in Lawrence county and the two are in Pennington county.

The Deadstroke mine in the Black Trail district is mining ore at an expense of thirty-five cents a ton. The manager of the cyanide plant which treats the ore says that the gold is extracted for seventy-five cents a ton, making the total cost for mining and milling \$1.10. The ore runs about \$8 a ton in gold and is taken from a ledge which is over 300 feet wide and which runs for several miles.

Lead now claims to be the most prosperous city in South Dakota. The recent increase in attention given to mining has resulted in an increased population which makes Lead the second largest city in the state. It is claimed that the Homestake Company is the greatest gold dividend payer in the world. It employs 2,200 men and ships twelve gold bricks yearly, each of which is worth about \$35,000. The Homestake practically supports a city of 8,000 people. The largest cyanide plant in the world is being built there, and it is claimed that enough ore is already blocked out in the mine to keep the mill busy more than twenty years.

UTAH.

W. H. Brevoort has sold his interest in the Carissa at Tintic, and Eben Smith of Colorado and H. A. Cary of Salt Lake City are now in full control. The Carissa sent to the market in September ores valued at \$6,000, and the record for October was twenty-five cars of high grade ore.

A thirty-ton plant will be put up by the Butterfield Company of Brigham and will be in operation by January 1.

A body of excellent lead carbonate has been struck in the drift off the tunnel level in the Honerine mine at Stockton.

BRITISH COLUMBIA.

Phoenix camp has broken its record in ore shipments, having sent out in one week 5,000 tons. The largest amount for a single day was thirty-one carloads amounting to over 1,000 tons.

Marcus Daly has thirty men at work in the Similkameen district opening up the Nickel Plate claims. He is using nine machine drills. This is a gold property carrying from \$20 to \$35 to the ton. Conditions are unfavorable for profitable

production at present, but an improvement is expected along these lines. Transportation facilities are lacking and other disadvantages will have to be endured for the present.

The Hayes group of copper mines on the west coast of Vancouver Island has been under examination by miners who think of purchasing. The price asked is \$600,000, which is an advance of over \$100,000 since last spring.

IRON AND STEEL

BRITISH INQUIRY FOR STEEL: Consul Marshal Halstead writes from Birmingham, October 18, 1900, that he is in receipt of a communication from a steel-manufacturing company which contains an inquiry for American steel for making forks, Siemens or Bessemer process, and requests the names of firms manufacturing high carbon steel of this sort.

FRENCH COAL AND IRON PRODUCTION: The Minister of Public Works for France has just published the statistics of the production of coal, iron and steel in his country for the first six months of the current year.

The production of anthracite and bituminous coal was 16,196,960 tons of 1,000 kilograms (2,204,6 pounds), as compared with 16,101,076 tons during the same period of 1899, an increase of 95,880 tons; that of lignite, 332,921 tons, compared with 282,712 tons in 1899, an increase of 50,209 tons, making a total production of mineral combustibles for the first six months of 1900 of 16,529,887 tons, as compared with 16,383,788 tons in 1899, a total increase of 146,099 tons for the first half of the year.

The annual consumption of coal in France is about 42,000,000 tons, and the production 32,000,000 tons, leaving 10,000,000 tons to be imported to supply the deficiency. Of this latter, about 7,000,000 tons are brought from Great Britain and 2,000,000 tons from Belgium and Germany. If American miners and shippers of coal can solve the question of cheap ocean transportation of coal to French ports, they will have fine prospects, even when the prices become normal, of sharing with Great Britain the 7,000,000 tons which that country is yearly sending to France. To do this, the freight rates to French ocean ports should be reduced to about \$2.50 per ton.

COAL AND COKE

ANTHRACITE PRICES IN THIRTY-FIVE YEARS: A correspondent of the Evening Star of Washington, D. C., has prepared an interesting letter regarding coal prices, which is of some interest at the present time. He writes:

In view of the fact that the price of coal is booming upward, and people are complaining of its rise, it may be interesting at this time to compare the price of that article in this city thirty-five years ago and now. Then (as the opponents of trusts assert) the word "trust," as applied to firms and corporations, was unknown; it was the era of small business firms, when anyone could embark in trade and make a success of it if he had pluck and industry. Perhaps in those days they did not have combinations of business, but whether or not, the people who bought had sometimes to pay dearly for some articles. What would we say if we had to pay \$16 and \$19 a ton for coal, the dealers marking from 100 to 125 per cent? And yet it has touched those figures. Looking, a short time ago, over the reports of the board of trustees of Odd Fellows' Hall, Seventh street, this city, I was struck by the high rates paid for coal the last years of the war of the rebellion and later on. They are as follows:

September, 9, 1864, four tons.....	\$64
January 6, 1865, four tons.....	60
February 15, 1865, four tons.....	60
October 21, 1865, four tons.....	56
February 6, 1866, four tons.....	56
October 3, 1866, eight tons.....	76
October 13, 1868, eight tons.....	76
December 20, 1870, two tons.....	17
February 16, 1871, two tons.....	17
January 19, 1872, two tons.....	17

I was told to-day by an old Washingtonian who was clerking for a coal dealer in this city in 1863 and 1864 that his employer in that year laid in 3,200 tons, at a cost of \$8 a ton, dumped into his yard, and retailed it at \$19. He cornered the market and charged what he pleased. But some will say, "Oh, those are war figures." Not all of them, for on October 21, 1865 (six months after the surrender at Appomattox), coal sold at \$14 a ton.

"There were no trusts in the good old days." No, there were not; but there were some ugly "corners," and men made fortunes out of the distress of their neighbors. Suppose there had been "trusts" in 1864 and 1865. If individuals at that time charged 100 per cent the greedy corporations would have gone higher. "There is nothing new under the sun."

AUSTRALIAN COAL: John Plummer of Sydney, New South Wales, contributes to the Black Diamond a letter, from which the following information is taken:

At the present moment, when the demand for coal is larger than at any previous period of the world's history, the importance of the Australian supply has become generally recognized. Coal deposits exist in all the Australian colonies, the largest being in New South Wales, and the smallest in South Australia. In the former colony, according to Mr. Coghlan, the government statistician, the carboniferous formations extend over a considerable portion of its area, and workable coal seams have been discovered in many places. At present, however, the coal mining industry is confined to those centers which, from their close proximity to ports of shipment or the railway lines, afford ready means for the disposal of the commodity when raised.

The area over which coal is distributed is very great, and has been computed at 23,950 square miles; besides this, it is known to underlie the Hawkesbury sandstone in and around Sydney. Shafts are being sunk on the shores of Sydney harbor to work a seam of coal over ten feet in thickness, the existence of which was ascertained by a bore at a depth of 2,923 feet. A coal seam six feet, six and a half inches thick has been found on the Moorbank estate, near Liverpool, at a depth of 2,583 feet. Coal has also been found in the Clarence series, though it has not yet been worked commercially. In 1898 the quantity was 4,706,251 tons, value £1,271,322, the price of coal having since advanced. The total production to the close of 1899 was 35,969,136 tons, representing a value of £35,647,004. The quantity of coal exported during 1899 was 2,798,523 tons, value £1,005,794; the places outside the Australian colonies to which shipments were made being Ceylon, Fiji, Hong Kong, India, Mauritius, New Guinea, Straits Settlements, Celebes, Chili, China, Cochin China, Ecuador, Hawaii, Japan, Java, Marshall Islands, Mexico, Molucca Islands, Mozambique, New Britain, New Caledonia, Panama, Peru, the Philippines, South Sea Islands, and America. A few hundred tons were also shipped to Great Britain. The output for 1900 is expected to be the largest on record.

BRITISH EXPORTS AND PRICES: The statistics of the British exports of coal for the month of September show a material increase as compared with the corresponding month of 1899, while the exports for the nine months show an increase of 1,828,364 tons, which is likely, before the end of the year, to be increased to over 2,000,000 tons. This increase is, however, by no means phenomenal. It has several times been exceeded in the records of our coal exports, and especially so in the year 1899, when for the first nine months of the year our coal exports were fully 6,000,000 tons in excess of the corresponding exports of 1897. That, however, was due to special causes, and notably to the great strike of miners in South Wales, which seriously reduced the output of the principality. The export coal trade cannot, therefore, be blamed for the great advance of prices that has taken place in 1900. Neither can the quantities of coal appropriated to the bunkers, for the official records show that the shipment of bunker coal for the first nine months of the year were 400,000 tons under those of the corresponding period of last year. If we are to seek for a true explanation of the causes of the coal boom of 1900 we must look to other sources of demand. The high price of coal is now beginning to have the inevitable effect of high prices, and, except for special conditions existing in one or two countries, to reduce the demands of the majority of our customers. There will be many who will pronounce this to be the beginning of the end of high prices. We are not, however, so sure of that. The export trade at the most only takes about one-fifth of our whole production, and if the other four-fifths are increasing their orders, the influence of the export demand would not be conclusive. As it happens, this influence is being supported by that of bunker shipments, and this may ordinarily be taken as a sign that shipping business is falling off, which, again, is an evidence that the boom does not possess the strength and stability that it did.—London Daily Graphic.

DOMINION COAL MINING CO., Danville; \$750,000; F. C. Lorey.

IOWA.

KESTONE COAL MINING CO., Des Moines; \$6,000; J. M. McRae.

CHEAGO MINING & MILLING CO., Des Moines; \$60,000; H. Edsworth.

DIAMOND JEW COAL CO., Des Moines; \$10,000; Mrs. J. Ramsay.

MAINE.

COOL RIVER OIL CO., Portland; operating in oil lands; \$30,000; J. T. Freeman, Boston, Mass.

CARMICHAEL REDUCTION CO., Portland; \$250,000; J. M. Marsh, Lynn, Mass.

MINNESOTA.

NORTHERN ORE CO., Duluth; \$50,000; W. Elder.

MISSISSIPPI.

MISSISSIPPI FOUNDRY & MACHINERY CO., Jackson; \$10,000; F. C. Council.

MISSOURI.

JOPLIN IRENE LEAD & ZINC CO., Joplin; \$50,000; C. Sparrow.

FOWLER COAL & MINING CO., Richmond; \$7,000; A. M. Fowler.

BRINKLEY COAL CO., Kansas City; \$8,000; V. M. Murphy.

CROWN PRINCE MINING CO., Joplin; \$100,000; W. E. Johnson, Waterloo, Iowa.

G. ZINC OXIDE CO., West Plains; reduction and smelting ore and making zinc oxide; \$10,000; C. L. Coyner.

NEBRASKA.

ELKHORN TUNNEL & MINING CO., Omaha; \$3,000; C. H. Gulon.

NEW JERSEY.

RICH ROCK MINING & MILLING CO., Camden; \$1,000,000; D. Z. Evans.

NEW JERSEY CLAY MINING CO., Tuckerton; mine clay; \$300,000; J. R. Cantlin, Philadelphia, Pa.

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Advertisements of this class containing not more than five lines will be inserted for not exceeding three months in any year, free of charge, for all paid-up annual subscribers.

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EXPERIENCED promoter and stock operator wanted to handle the stock of a reliable Gold Mining Co., on most liberal terms. For particulars, address C. L. WARFIELD, Room 22, Brunswick Blk., San Diego, Cal.

WANTED.—Position as superintendent by pushing and up-to-date mining engineer, who understands all branches of mining and milling gold ores. Has his own assay outfit, and would be willing in a small mine to do the assaying and surveying. Address, D. P. A., Mining and Metallurgical Journal.

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SANTOS VARONES MINING CO., Sidney; \$10,000; W. A. Perry.

CRESCENT OIL CO., Jackson; \$1,000; E. V. O. Roberts.

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UREY RIDGE COAL CO., Urey; \$30,000; J. Bel-Hs.

HIGH RUN COAL MINING CO., Philadelphia; \$20,000; J. Cox, Jr.

SOUTH MOUNTAIN MINING & MANUFACTURING CO., Philadelphia; \$15,000; J. C. Belz.

WEST COAL & MINING CO., Lock Haven; \$1,000; H. T. Harvey.

OZARK MINING CO., Couderport; \$2,000; C. C. Rees.

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MOUNT BLANCHARD OIL & GAS CO., Sandusky, O.; general oil and gas business; \$20,000; J. Flynn.

HELL CREEK COAL CO., Belva; \$50,000; F. P. Havener, Parkersburg.

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SECURITY ZINC & LEAD CO., Springfield, Mass.; \$100,000; F. B. Powers.

LA PLATA CONSOLIDATED MINING & MILLING CO., Brooklyn, N. Y.; \$500,000; H. Carpenter.

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INTERSTATE COAL CO., Clarksburg; \$100,000; J. S. Blair, Greenville, Pa.

BLACK HAWK MINING CO., Concord, N. H.; \$1,000,000; G. B. Holden, Boston, Mass.

WASHINGTON QUARTZ GOLD MINING CO., Chicago, Ill.; \$500,000; W. A. Green.

FOREST HILL GOLD MINING CO., Chicago, Ill.; \$500,000; W. A. Green.

PORLAND COPPER MINING CO., Boston, Mass.; \$1,500,000; F. Keezer, East Hempstead, N. H.

KEYES CREEK COAL CO., Cincinnati, O.; \$150,000; C. F. E. Nerman.

ROYAL COPPER CO., Charleston; \$1,000,000; J. Hatchet.

ANTHRAZITE COAL CO., New York City; general coal and coke business; \$1,000,000; A. Mackenzie.

THE METAL MARKETS.

As we go to press (November 13) the following prices prevail for the leading metals:

Commercial price of bar silver in New York, 64½c.; bar silver in London, 23 11-16d. Mexican silver dollars were quoted 51½c. Exports to Europe were announced for November 14 at 280,000 ounces.

Copper, Lake, 16½@17c.; Electrolytic, 16½c.

Tin, \$26.65 to \$27.75; tin plates, \$4 at mill.

Lead, 4.37½c.

Spelter, St. Louis, 4.10c.; New York, 4.25c.

Iron—No. 1 Northern, \$15@16; No. 2 Northern, \$14.50@15.50; pig iron warrants No. 2, \$9@10.

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BUYERS' GUIDE

Our Buyers' Guide is arranged to assist those who expect to purchase machinery and supplies to find quickly and easily the addresses of the leading dealers. A postal card addressed to this paper will bring you the catalogues of all houses named under any classification.

AIR COMPRESSORS

Edw P Allis Co., Milwaukee, Wis.

Chicago, Ill.

M C Bullock Mfg Co., Colorado Iron Works, Denver, Colo.

Denver, Colo.

W H Emanuel, Eng Co., Parkersburg, W. Va.

Parkersburg, W. Va.

Earth & Metal Mfg Co., Chicago, Ill.

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Fairbanks Morse & Co., Chicago, Ill.

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Joshua Hendy Machine Works, San Francisco, Calif.

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Ingersoll-Sergeant Drill Co., N. Y. City.

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Sullivan Machinery Co., Chicago, Ill.

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Union Foundry Co., San Francisco, Calif.

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Dally & Monfries, Denver, Colo.

Denver, Colo.

Wm M Courtis, Detroit, Mich.

Detroit, Mich.

Louis Falkenau, Philadelphia, Pa.

Philadelphia, Pa.

Hamilton & Morrison, Philadelphia, Pa.

Philadelphia, Pa.

A. A. Hanks, Clarence Hersey, Philadelphia, Pa.

Philadelphia, Pa.

Clarence Hersey, Philadelphia, Pa.

Philadelphia, Pa.

Ogden Assay Co., Denver, Colo.

Denver, Colo.

Laurel Assay Co., San Bernardino, Calif.

San Bernardino, Calif.

John T Reed, San Bernardino, Calif.

San Bernardino, Calif.

(Continued on page VII.)

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See Page XV



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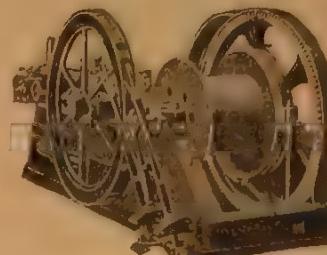
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Especially Adapted for Mining Purposes.

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(Continued from page 64.)

D W Rockhart,
Bickford & Banks,
Helly Smelting & Lead Co.,
John H. Simonds,
Smith & Wainwright,
Schoell Oil Milling Works,
Ward & Wade,
Henry E WardEl Paso, Tex
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8 Francisco, Cal
8 Francisco, Cal
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Denver, Colo
Los Angeles, Cal
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Gutta Percha & Rubber Mfg Co.,
Goodwyn Rubber Co.,
I. S. H. Hendy Machine Wks.,
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Shultz Belling Co.,
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Lidgerwood Mfg Co.

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S S Machinery Co.

Wm B Seale & Sons,

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(Continued on page XI)

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"GRAND PRIX"

At the Paris Exposition

The following Awards have been officially announced:

GRAND PRIX,	- - -	Group XI, Class 63, Mining Apparatus.
Gold Medal,	- - -	" IV, " 21, Compressors.
Silver Medal,	- - -	" VI, " 28, Models of Apparatus used on Chicago Drainage Canal.
Honorable Mention,	- - -	" IV, " 29, Small Motors on Channellers; Various Motors.

This Company has received the only GRAND PRIX awarded to any Manufacturer in this line.

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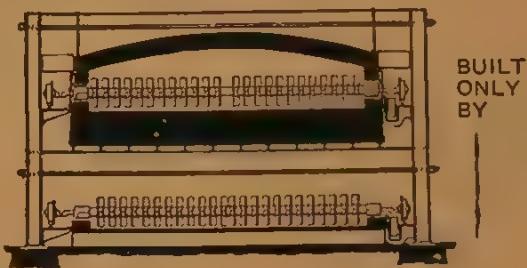
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OF THE

WETHEY MULTIPLE DECK AND
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WE CLAIM—That These Furnaces are built from Original Designs fully covered by Strong Patents which we control and will Protect. The design embodies NUMEROUS NEW FEATURES in the construction of Ore Roasting Furnaces and Does Not Imitate or rely on any of the old and very faulty models.

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SULLIVAN MACHINERY CO.

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Sullivan Diamond Prospecting Drills

For Prospecting for and Developing Minerals

Rock Drills for Sinking, Drifting and Stoping

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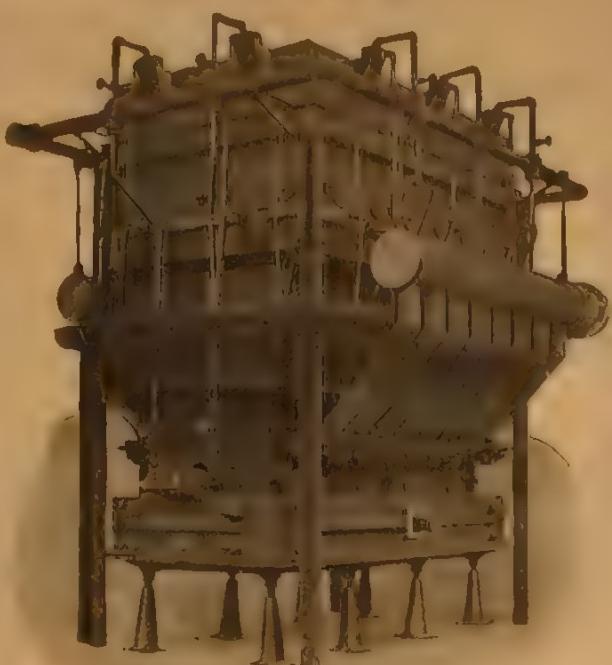
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The Copper Matting Furnace

here illustrated, shows our latest type RECTANGULAR COPPER MATTING FURNACE, with Flange Steel Jackets, and Cast Iron Auxiliary Jackets above. Being entirely independent of lower jackets and supported by the four columns and mantel frame, this Matting Furnace requires no brick work except that necessary to line the hearth.

We manufacture SMELTING FURNACES and EQUIPMENTS for the treatment of

Gold, Silver, Lead,
Copper and Nickel Ores

of any desired tonnage capacity above 40 tons per day and put them into successful operation under guarantee.

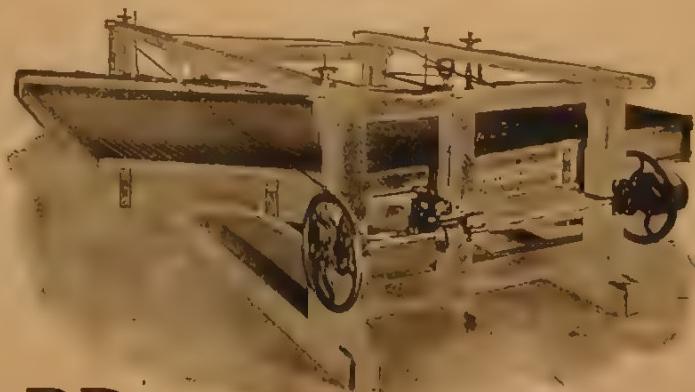
Write for catalogue showing different styles of furnaces. We are the originators of the Narrow Face, Large Diameter, High Speed Crushing Rolls. A full description of crushing machinery is given in a special catalogue.

We are sole manufacturers of the IMPROVED BARTLETT CONCENTRATING TABLE. Our special catalogue on this subject gives all the latest information on the concentration of Ores.

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Established 1860

Denver, Colo., U. S. A.



NEW STANDARD CONCENTRATOR

A Concentrator which establishes a NEW STANDARD in the concentration of Ores; Saves a larger percentage of mineral, as it saves both coarse and fine;

Requires little attention, has the greatest range of adjustment, and requires less water than any other Concentrator made; Requires less than one-quarter horse-power to run it; has few working parts and no wearing parts; made strong and durable; will out-last any other Concentrator made; no parts to wear out or break, and any necessary replacements can be made in a few moments.

No. 2 New Standard Concentrator will handle from 15 to 30 tons of material per 24 hours, depending upon percentage of concentrates. The machine will produce one ton of concentrates per 24 hours from material carrying 5 per cent of heavy mineral, turning out a product free from silica.

The table is hung free from the operating mechanism, and the motion of the table does not wear or strain the working parts.

Weight of machine, crated, 1600 pounds.

Price, \$400.00 f. o. b.

**New Standard
Concentrator Co.**

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BOILER COVERING

California Anti-Caloric Co., 8 Francisco, Cal.

BOILER TUBE CLEANERS

Coggeshall Mfg Co., N Y City

BOOKS

Mining & Metallurgical Journal, N Y City

Pittsburgh Iron Co., Philadelphia, Pa.

D. Van Nostrand Co., N Y City

BOTTLES

American Injector Co., Detroit, Mich.

Joshua Hendy Machine Wks., 8 Francisco, Cal.

CARS (DUMP and MINE)

Edw P Allis Co., Milwaukee, Wis.

Link-Belt Mfg Co., Chicago, Ill.

Colt's Iron Works, Chicago, Ill.

Emersons, Morse & Co., Chicago, Ill.

Joshua Hendy Machine Wks., 8 Francisco, Cal.

Thomson & Baylo, Los Angeles, Cal.

Weber Gas & Gasoline Eng Co., Kansas City, Mo.

CARS (CASTING)

Chrome Steel Wks., Brooklyn, N Y

Joshua Hendy Machine Wks., 8 Francisco, Cal.

Longfellow & Co., Springfield, O

Ruggles-Cole Engineering Co., N Y City

Sullivan Machinery Co., Chicago, Ill.

CHEMICALS

Baker & Adamsen Chemical Co., Easton, Pa.

F. W. Braun & Co., Los Angeles, Cal.

Doway Fire Clay Co., Denver, Colo.

Richards & Co., Ltd., N Y City

Roesler & Haasleher Chemical Co., N Y City

John Taylor & Co., San Francisco, Cal.

Western Chemical Co., Denver, Colo.

COAL CRUSHERS

Link-Belt Machinery Co., Chicago, Ill.

Williams Patent Crusher & Pulverizer Co., St Louis, Mo.

COAL CUTTERS

Ingersoll-Sergeant Drill Co., N Y City

Jeffrey Mfg Co., Chicago, Ill.

Link-Belt Machinery Co., Chicago, Ill.

Sullivan Machinery Co., Chicago, Ill.

COAL-HANDLING MACHINERY

M.C. Bullock Mfg Co., Chicago, Ill.

Jeffrey Mfg Co., Chicago, Ill.

A. Longden & Sons Hoop Co., St Louis, Mo.

Robins Conveying Belt Co., Chicago, Ill.

8 & Machinery Co., Denver, Colo.

Trenton Iron Co., Trenton, N J.

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Edw P Allis Co., Milwaukee, Wis.

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Joe Dixon Crucible Co., Jersey City, N J.

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(Continued on page XI.)

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For Flour and Meal, Grains, Sacks,

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The good qualities of Chain Pipe Wrench and Screw Pipe Wrench combined, without the faults of either. Quick, effective and positive in adjustment. Cannot slip, crush or lock on the pipe. Made in four sizes: 10, 18, 24 and 36-in. Handling from $\frac{1}{2}$ -in. wire to 4 $\frac{1}{2}$ -in. pipe. Price no higher than other Pipe Wrenches on the market.

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The Johnston Patented Pipe Wrench

Our 24-inch Wrench is the Best Tool of its kind in the World

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J J Knapp & Co, Philadelphia, Pa
L Mannes Co, Chicago, Ill
Queen & Co, Philadelphia, Pa
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Lidgerwood Mfg Co, N Y City
Holden Conveying Belt Co, N Y City
Weber Gas & Gasoline Eng Co, Kansas City, Mo

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Edw P Allis Co, Milwaukee, Wis
American Diamond Rock Drill Co., N Y City
M C Bullock Mfg Co, Chicago, Ill
W H Emanuel, Denver, Colo
Joshua Hendy Machine Wks, 8 Francisco, Cal
Howells Mining Drill Co, Plymouth, Pa
Ingersoll-Sergeant Drill Co, N Y City
Willis Shaw, Chicago, Ill
Sullivan Machinery Co, Chicago, Ill
J Wigmore & Sons Co, Los Angeles, Cal

DRILL STEEL

M C Bullock Mfg Co, Chicago, Ill
J Siva Hendy Machine Wks, 8 Francisco, Cal
Ingersoll-Sergeant Drill Co, N Y City

DRIVERS

Colorado Iron Wks, Denver, Colo
J D Cummer & Sons Co, Cleveland, O
Joshua Hendy Machine Wks, 8 Francisco, Cal
Ruggles & Co's Engineering Co, N Y City

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Edw P Allis Co, Milwaukee, Wis
M C Bullock Mfg Co, Chicago, Ill
Colorado Iron Wks, Denver, Colo
Laubanks, Morse & Co, Chicago, Ill
Joshua Hendy Machine Wks, 8 Francisco, Cal
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Trenton Iron Co, Trenton, N J
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Jeffrey Mfg Co, A Loschen & Sons Rope Co, Columbus, O
Link-Belt Machinery Co, St Louis, Mo
Robins Conveying Belt Co, N Y City
8 Machinery Co, Denver, Colo

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M C Bullock Mfg Co, Chicago, Ill
Jeffrey Mfg Co, Denver, Colo
Jas Leffel & Co, Columbus, O
Clay C Moore & Co, Springfield, O
Francisco, Cal
Murray Iron Works Co, Burlington, Ia
Ortodox Gas Engine Co, 8 Francisco, Cal
S & M Machinery Co, Denver, Colo
8 Francisco, Cal
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E Du Ligon Co, Chicago, Ill
Adolf Frese, Los Angeles, Cal
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L Mannes Co, Chicago, Ill
Queen & Co, Philadelphia, Pa
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FORGINGS

Fulton Engine Wks, Los Angeles, Cal
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Colorado Iron Wks, Denver, Colo
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Low E Anthony, Los Angeles, Cal
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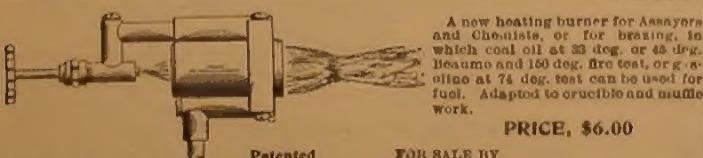
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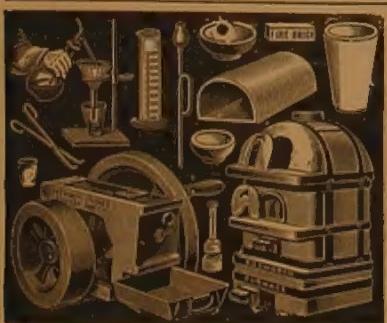
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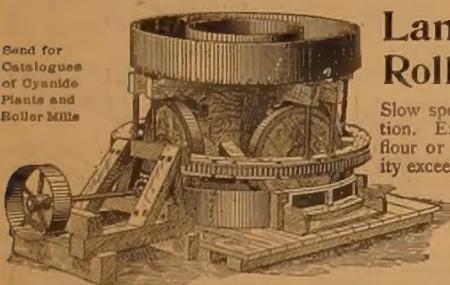
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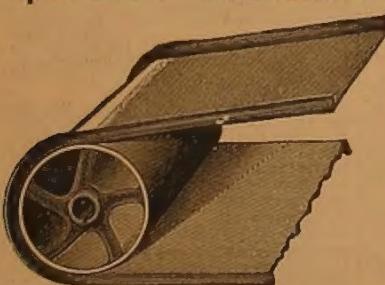


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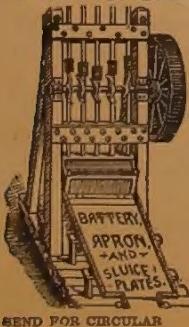
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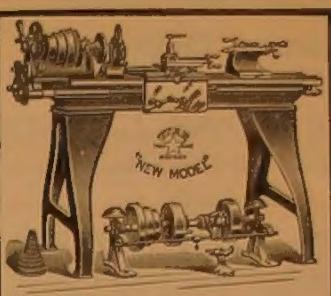
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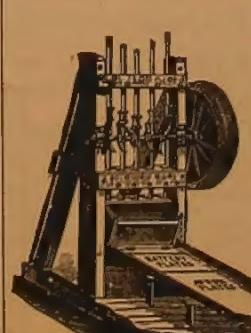
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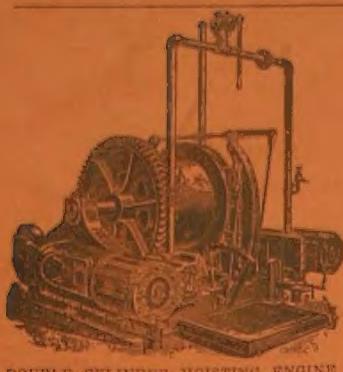
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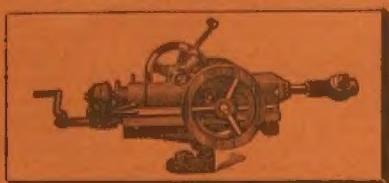
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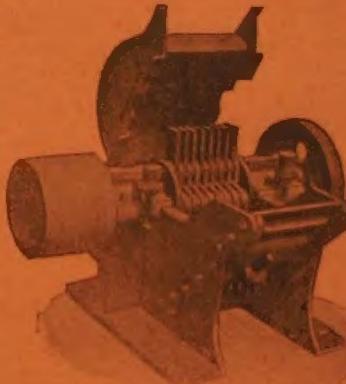
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